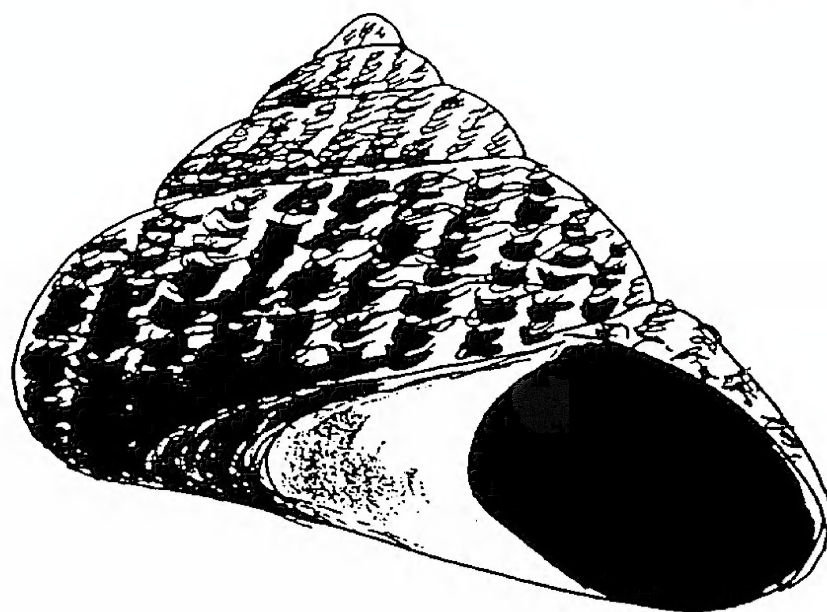


COOKIA



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Charopa planulata Hutton, 1883, a species of *Chaureopa* Climo, 1985

(Pulmonata: Charopidae)

By F.M. Climo & K. Mahlfeld

A lectotype for *Charopa planulata* Hutton, 1883 (Canterbury Museum, Christchurch M12773) is selected and illustrated. *C. planulata* is a species of *Chaureopa* Climo, 1985. *Chaureopa* is expanded to include *Allodiscus rusticus* Suter, 1894 and *Flammulina* (*Allodiscus*) *mossi* Murdoch, 1897, both of these with colour-patterned shells of similar size, shape and sculpture to the unicoloured, narrowly umbilicate *Chaureopa* species. Lectotypes are selected for these two species as well. When mapped (Fig. 1B) these taxa indicate a broad East Cape - Mount Taranaki diagonal convergence and overlap of the unicoloured and colour patterned groups. Vicariance of flat, widely umbilicate and rounded, narrowly umbilicate species map a main biogeographic track, Mount Hikurangi - Hunua - Whangaparaoa. Greatest species diversity is found in the 1° grid square stippled in Fig. 1B.

Key words: *terrestrial molluscs, New Zealand, new combinations of names, Charopidae*

INTRODUCTION

Colour patterned *Chaureopa* recombine shell features of eastern South Island *Allodiscus* species such as *A. adriana* Hutton, 1883 with the distinctive reproductive system features of a strongly colour patterned new species of *Phacussa* Hutton, 1883 from Stewart Island (Climo, in preparation), with shell architecture, protoconch and teleoconch sculpture of the unicoloured species of *Chaureopa* Climo, 1985. *Allodiscus mossi stewartensis* David 1934 is not easily classified in the *rusticus*-*mossi* part of *Chaureopa*. Anatomical and shell features place it close to *Phacussa hypopolia* (Pfeiffer, 1853), one of several named species of *Phacussa* with predominantly weakly colour patterned shells, restricted to the South Island and the entrance to Paterson Inlet, Stewart Island. As far as they go in this publication, these observations cover Powell's (1979: 231) comments on the identity of *P. stewartensis* David, variable from the types collected from Native Island and represented by recent and fossil specimens. For biogeographic purposes *C. rusticus* Suter and *C. mossi* Murdoch are mapped as one biological entity in Fig. 1B pending further study.

Abbreviations used for institutions - NMNZ, Museum of New Zealand Te Papa Tongarewa, Wellington, New Zealand; CM, Canterbury Museum, Christchurch, New Zealand.

TAXONOMY AND COMMENTS

Chaureopa planulata (Hutton, 1883) n. comb.

Fig. 1

Charopa planulata Hutton, 1883: 477.

Charopa planulata. - Hutton, 1884: 181, pl. 25, fig. 14, a, b.

Flammulina (*Allodiscus*) *planulata*. - Suter, 1894b: 252. Not Hutton, 1883.

Allodiscus planulatus. - Suter, 1909: 34. Not Hutton, 1883.

Allodiscus planulatus. - Suter, 1913: 643. Not Hutton, 1883.

Allodiscus planulatus. - Dell, 1954: 139. Not Hutton, 1883.

Allodiscus planulatus. - Powell, 1955: 123. Not Hutton, 1883.

Allodiscus planulatus. - Powell, 1979: 321. Not Hutton, 1883.

Allodiscus planulatus. - Solem *et al.*, 1981: 478. Not Hutton, 1883.

Allodiscus planulatus. - Dawson, 1994: 109 (after Powell, 1979).

Allodiscus planulatus. - Marshall, 1995: 498.

Allodiscus planulatus. - Spencer & Willan, 1996: 40. Not Hutton, 1883.

Charopa planulata. - Freeman *et al.*, 1997: 31.

Type data: Lectotype (here selected) CM M12773, and 2 paralectotypes CM M1039. The species is known only from the type material and was collected by Cheeseman from "Auckland". Most post 1884 references to *Allodiscus planulatus* (Hutton, 1883) refer to an undescribed species of *Allodiscus* Pilsbry, 1892.

Comments: Hutton's (1883: 477) initial description of the species is very brief. His 1884 (p. 181) description of the shell of *Charopa planulata* mentions that the horny brown shell is sometimes coloured with rufous but the type specimens are now faded to a light straw-gold, with no hint of colour patterning. Hutton did not mention that the protoconch is glossy smooth, which in conjunction with the mainly golden brown shells of similar architecture and sculpture, places *Charopa planulata* Hutton in the charopid genus *Chaureopa* Climo, 1985.

C. planulata is flatter than the other narrowly umbilicate species and both base and columellar lip are folded to nearly close the umbilicus (Fig. 1A).

Chaureopa rusticus (Suter, 1894) n. comb.

Fig. 1B

Allodiscus rusticus Suter, 1894a: 135, pl. 20, figs 37, 37 a, 37 b.

Flammulina (*Allodiscus*) *rustica*. - Suter, 1894b: 254.

Allodiscus rusticus. - Suter, 1913: 644, pl. 9, figs 4, 4 a, 4 b.

Allodiscus rusticus. - Powell, 1979: 320.

Phenacohelix rusticus. - Solem *et al.*, 1981: 480.

Phenacohelix rusticus. - Spencer & Willan, 1996: 40.

Type data: Lectotype (here selected) NMNZ M125171 and paralectotype NMNZ M125172. Thames, T.F. Cheeseman.

Comments: Suter's two syntypes [Suter colln 2178; NMNZ] of *A. rusticus* Suter, 1894 from Thames and Murdoch's co-types of *Flammulina* (*Allodiscus*) *mossi* Murdoch, 1897 in the Suter colln (2054), collected by Murdoch from Toko near Stratford, have glossy protoconchs with widely spaced axial crinkles and traces of a finer axial component (by reflected light), a similar base, and palatal apertural calcareous thickening. The syntypes of *C. rusticus* are more loosely coiled, have a weaker - though similar - colour pattern (contrary to the literature) and a shallower suture than the co-types of *C. mossi*.

C. mossi (Murdoch) is not synonymised with *C. rusticus* (Suter) here, pending more detailed comparative work, though *C. rusticus* is used - as the earliest name - for both taxa in Fig. 1B (dots and thin lines).

Chaureopa mossi (Murdoch, 1897) n. comb.

Fig. 1B

Flammulina (*Allodiscus*) *mossi* Murdoch, 1897: 162, fig. in text.

Allodiscus mossi. - Suter, 1913: 642, pl. 25, fig. 13, 13 a, 13 b.

Allodiscus mossi. - Powell, 1979: 320-321.

Allodiscus mossi. - Spencer & Willan, 1996: 40.

Type data: Lectotype (here selected) NMNZ M125138 [Suter colln 2054] and paralectotype (here selected) NMNZ M125137, Toko near Stratford, Taranaki, R. Murdoch.

Phacussa stewartensis (David, 1934) n. comb.

Fig. 2B

Allodiscus stewartensis David, 1934: 131.

Allodiscus mossi stewartensis. - Dell, 1954: 141.

Allodiscus (?) *stewartensis*. - Powell, 1979: 321.

Allodiscus stewartensis. - Spencer & Willan, 1996: 40.

Type data: Senckenberg Museum, Frankfurt-am-Main, Germany; "Paterson-Bay, Stewart Inseln", April 1924.

Comments: This is the smallest species of *Phacussa* Hutton, 1883, common in Otago and Southland, which extends via Bluff Hill to the entrance of Paterson Inlet, Stewart Island. It has the same reproductive anatomical features as the type species, *P. hypopolia* (Pfeiffer, 1853), found mainly in the north of the South Island.

The retractor muscle of *hypopolia*-group *Phacussa* species fastens to both the epiphallic lobe and retractor muscle lobe (Fig. 2B), whereas the retractor muscle of *fulminata*-group *Phacussa* species (the strongly colour-patterned Stewart Island species mentioned above) is attached to the retractor muscle lobe only (Fig. 2A). Both groups have pustulated lumina in comparison with the simple longitudinally ridged lumen of *Chaureopa* (Climo, 1985, Fig. 3).

ACKNOWLEDGEMENTS

We are grateful to M. Walker (Canterbury Museum, Christchurch) for the loan of type material.

Figure 1A: lectotype, *Charopa planulata* Hutton, 1883, Canterbury Museum M12773.

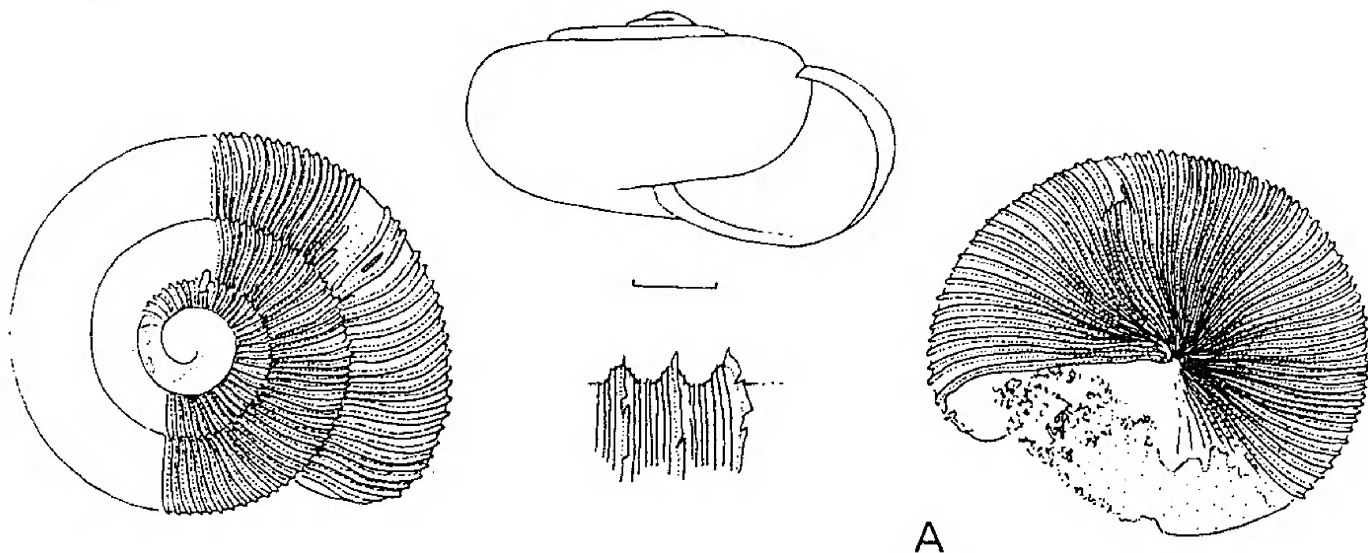
Sculpture not shown in profile view. Microsculptural detail, diagrammatic. Scale line, 1 mm.

Figure 1B: map showing broad north-south vicariance of *Chaureopa rusticus* (Suter, 1894) (small dots, thin lines) and *Chaureopa* species *sensu* Climo (1985) - other symbols. Large dots and open lines, *C. microumbilicata* Climo, 1985 plus (East Cape) *C. roscoeae* Climo, 1985 (most globular and narrowly umbilicate); black squares, *C. hazelwoodi* Climo, 1985 and open squares, *C. depressa* Climo, 1985 (linked by filled dashed lines, most flattened to weakly biconcave and widely umbilicate species); open triangles, *C. subdepressa* Climo, 1985 (not as flattened or widely umbilicate); open circles, *C. titrangiensis* (Suter, 1896) (Shell form intermediate between *depressa* + *hazelwoodi* + *subdepressa* and *microumbilicata* + *roscoeae* + *planulata*). Stipple indicates most speciose 1 degree grid square. Map based on collections of Museum of New Zealand Te Papa Tongarewa, Wellington.

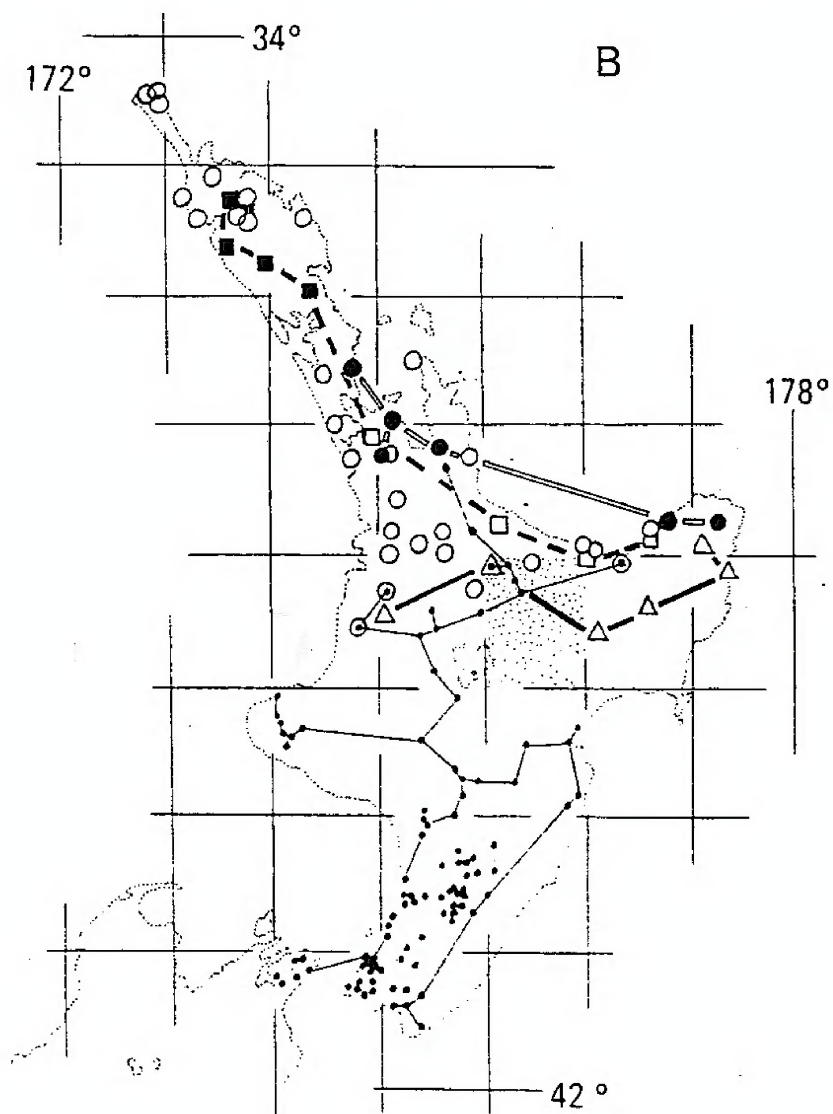
Figure 2A: Reproductive system, *Chaureopa rusticus* (Suter, 1894). Near Foxton, F.M. Climo, 1971. **Figure 2B:** Reproductive system, *Phacussa stewartensis* (David, 1934). Northern end, Te WaeWae Bay, Southland, P.R. Jamieson, 29.2.1976. Scale lines 1 mm. **Abbreviations:** a, atrium; a.g., albumen gland; ep., epiphallus; f.g., fold gland; h.d., hermaphroditic duct; o.v., oviduct; ov.L., ovotestis; p., penis; p.g., prostatic gland; p.r.m., penis retractor muscle; s., spermatheca and duct; t., talon; t.f., transverse fold; u., uterus; v., vagina; v.d., vas deferens.

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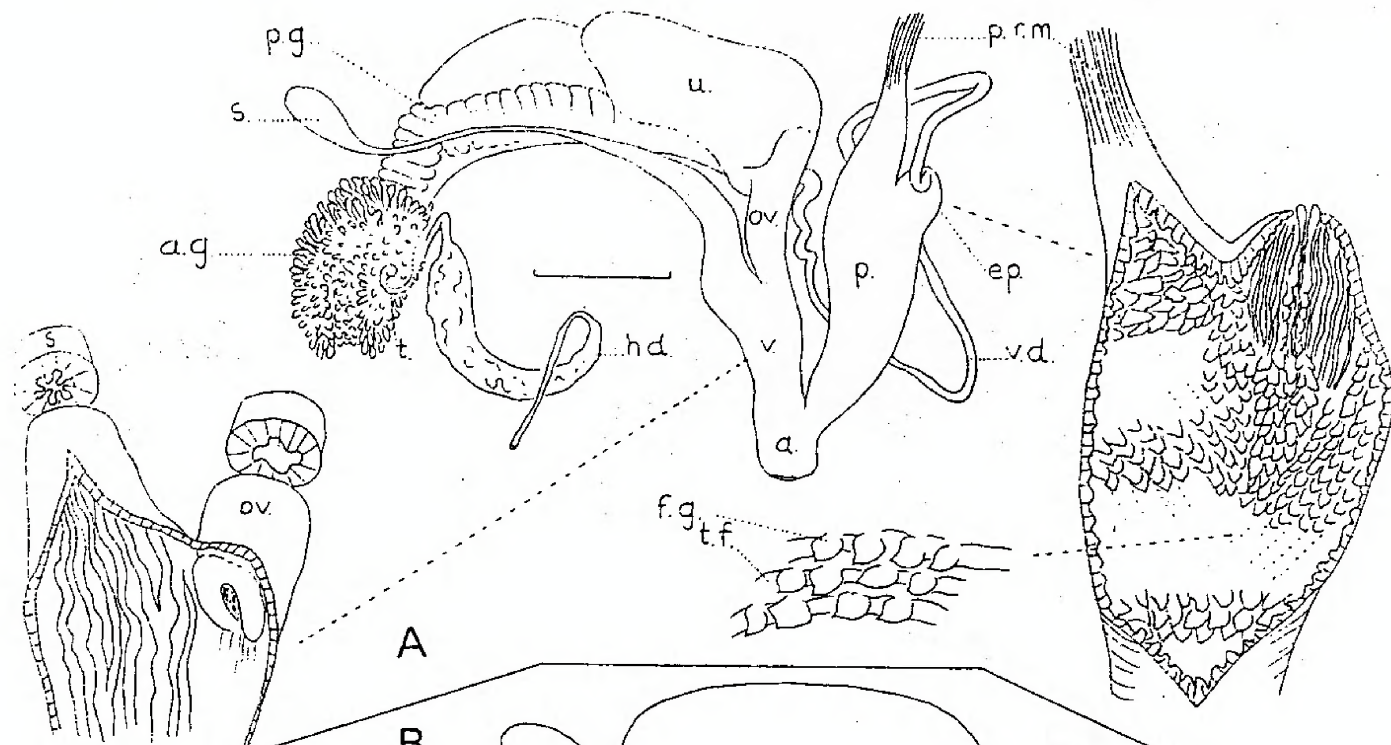
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A



B



SHELL COLLECTING AT MAHIA PENINSULA

By IAN TOWNSEND

Weather prospects for our weekend were not particularly brilliant, Hawkes Bay was due for a good soaking. This looked fairly obvious to us as we approached the Manawatu Gorge with black clouds clinging tightly to the hills on each side. Jenny Raven had picked up Heather and me at Levin and we were all prepared for the worst with parkas, over-trousers and gumboots! Most of the Bay lived up to the prediction, but late on the Friday afternoon as we travelled on from Wairoa there was a hint of optimism - the sky became lighter and although we all put off commenting for a while in case we upset the local meteorology ... yes, the road was quite dry! Mahia was like an island with a different climate and the people at the motels said there had been no rain all day. We happily settled ourselves in and prepared an evening meal. Jenny made the first molluscan discovery. She found a specimen of *Atalacmea fragilis* between the sheets of her bed! Now there's an interesting thought - How did it get there? Jenny swears she didn't bring it with her. No such presents in my bed. I settled down to read a few lines of Konrad Lorenz's King Solomon's Ring before dropping off.

Next morning there was a glimpse of sun through the clouds. The weather could do anything, but we set off regardless for Mahia Beach. Jenny drove us down to about the mid-point of the beach. It was suggested we should split up to cover more area so Heather and I walked towards the south-east end and Jenny towards Opoutama and the stream. I had cheekily declared I would find a *Semicassis labiata*, but after seeing only the occasional *pyrum*, I was beginning to have grave doubts. I turned back with only a specimen of *Dosinia subrosea*. (I collected it because it was not on Jenny's list of species for the area.) Wandering for a second time through a patch of small sticks brought in by the tide ... there was another *pyrum*, but then, almost completely hidden, a good specimen of *labiata*! This made my day - it was a new shell for me and one I had hoped to get. Later on comparing notes, it was the only one found on this trip. Back to the motel for morning tea (all very civilised, this shelling!) and then off to Oraka Beach, on the seaward side of the neck of land joining the Peninsula. This was a wonderful beach I had not visited before with extensive rocky reefs running out into the surf. The tide was approaching its lowest and there was no wind so viewing into the pools was great. Jenny had planned the trip for this occasion. Our mutual encounter with a *C. (M.) tigris* went something like this. I had just started to say, "Look there's a ..." when swoop went the Raven in a steep power-dive and it disappeared before my very eyes (quicker than you could read about it!).

Disappointingly for Jenny, the tip of the protoconch was very slightly damaged, and not good enough for her collection, so she kindly passed it to me for a record. I was truly grateful, because it was a very richly coloured specimen. I thought of the book I was reading last night - Lorenz had done an extensive study of jackdaws (closely related to ravens) and stated that their eyesight was many times better than a mere man's. I was certainly the latter. It was interesting to note that the *Alcithoe arabica* seen on this beach were fully mature but very small compared with the same species at Mahanga Beach which were normal size. We found some dark greyish coloured *Trivia* in the shell sand and the *Trochus viridis* were particularly green. Another interesting colour variant is the *Cookia*. Specimens are common on this beach and many of them are an orange-brown colour.

Jenny took me further along the beach to a ridge of harder rocks where specimens of *Cellana flava* can be found. Some of these have a dark brown streak in the shell. Oraka Beach was also particularly good for *Calliostoma punctulatum* and virgin pauas. After lunch we went to Auroa Point and had a good look in the shell sand. Jenny's technique is to dart about all over the beach when you first arrive scratching the lines of shell-drift with a stick to see if there is anything big and beautiful - she got a couple *Mitra carbonaria* in the high level drift by this method, while Heather and I had settled down to scratch a few square yards like a couple of chooks. We took some shell-sand away with us to work over later. This turned out to be

particularly rewarding, containing well over a hundred species if you include juveniles of larger species. Actually, some juveniles can look quite different to the fully mature shells and I doubt if I would be the first to think I had found something really interesting, only later to realise that it was none other than *Turbo smaragdus*! Other species are quite striking as juveniles, for instance, *Taron dubius* with their lolly-pink protoconchs. Of course anything with a large protoconch relative to the whole shell is immediately suspect, but I find bivalves are harder to recognise in their very young stages. (I have included juveniles of some large species in the appended list of species from shell-sand, because it is useful to be aware of their presence when you're at the "What is it?" stage.) After a while I noticed Jenny had settled on a small area of sand which she had been intensely searching for some time. She must have found something good, so curiosity got the better of me and I went over to see what she had found. Sure enough, she had come across a nice specimen of the corkscrew shell, *Tenagodus weldii*. It was just sitting on the top, here, she said. Strange that these shells that live embedded in sponge come up so naked on the beach. We also went to the far end of the road and looked at shell sand there because Heather could remember getting little cowries at that point some years ago. A cold wind developed but we persisted until poor light and a passing shower chased us off the beach.

Sunday was true to name, with a sunny start but showers were also on the agenda. After breakfast we again did a patrol of Mahia Beach, but nothing of particular note. Then we headed off north to Mahanga Beach. Mainly a sandy beach, but strangely at the north end where a small stream emerges there are deep drifts of shells, mostly *Austrofusus* and wheel-shells but also other odd things like *Atrina*, *Pecten novaezelandiae* and *Semicassis pyrum*. Heather got a nice specimen of *Alcithoe arabica* (full size). Jenny found a beautiful pair of an as yet unidentified oyster.

After lunch Jenny took us to the southern end of Mahia Beach and introduced us to the habitat of *Buccinulum colensoi*. They are living under stones at low tide - some are a dark purplish colour. The water was quite murky this day, with a rough sea stirring the silt from the papa cliffs. Jenny also showed me some irregular lumps of limestone which were in fact the shells of the oyster-like, *Cleidothaerus albidus*. We decided to go back to the Auroa Point area, more sheltered and a better chance of turning up unusual shells. This time it was my turn to find a corkscrew shell - not quite as complete as Jenny's, but still a reasonable example. After fish and chips at the restaurant that night, we packed our specimens.

Monday morning saw us have another look on Mahia Beach, down at the Opoutama end. Nice pairs of *Myadora striata* and *Soletellina nitida* were found. We had a further look at Oraka Beach and Auroa Point, before setting off for home shortly after mid-day.

For me, the weekend was a great learning experience thanks to Jenny passing on tips on collecting and introducing me to many new shell names.

SMALL SHELLS FOUND IN SHELL-SAND AT AUROA POINT : 9 AUGUST 1998

* = immature stages of larger species

BIVALVES

NUCULIDAE

Nucula nitidula (A. Adams, 1856)

Lamellinucula dunedinensis (Finlay, 1928)

NUCULANIDE

Saccella bellula (A. Adams, 1856)

ARCIDAE

Barbatia novaezelandiae (E.A. Smith, 1915)*

Arca sociella (Brookes, 1926)

PHILOBRYIDAE

Philobrya munita (Finlay, 1930)

Cosa filholi (Bernard, 1897)

MYTILIDAE
PECTINIDAE
UNGULINIDAE

ERYCINIDAE

KELLIIDAE
CYAMIIDAE
NEOLEPTONIDAE
CARDITIDAE
SEMELIDAE
VENERIDAE

HIATELLIDAE

Gregariella barbata (Reeve, 1858)
Chlamys zelandiae (Gray, 1843)*
Diplodonta (Zemysina) globus (Finlay, 1927)
Diplodonta (Zemysina) striatula (Finlay, 1927)
Melliteryx parva (Deshayes, 1856)
Lasaea hinemoa Finlay, 1928
Borniola reniformis (Suter, 1908)
Myllita (Zemylita) stowei (Hutton, 1873)
Myllitella vivens vivens Finlay, 1927
Kellia cycladiformis (Deshayes, 1834)
Kidderia (Costokidderia) costata Odhner, 1924
Neolepton antipodum (Filhol, 1880)
Cardita aoteana Finlay, 1927 *
Leptomya retziaria (Hutton, 1885)
Tawera spissa (Deshayes, 1835)*
Irus (Notirus) reflexus (Gray, 1843)*
Ruditapes largillierii (Philippi, 1849)*
Hiatella arctica (Linnaeus, 1767)

GASTROPODA

HALIOTIDAE
FISSURELLIDAE

PATELLIDAE

ACMAEIDAE

TROCHIDAE

Haliotis (Sulculus) virginea crispata Gould, 1847*
Emarginula striatula Quoy & Gaimard, 1834
Monodilepas sp.
Tugali suteri suteri (Thiele, 1916)
Cellana ornata (Dillwyn, 1817)*
Cellana radians (Gmelin, 1791)*
Asteracmea suteri (Iredale, 1915)
Patelloida corticata (Hutton, 1880)
Notacmea elongata (Quoy & Gaimard, 1834)
Herpetopoma bella (Hutton, 1873)
Herpetopoma larochei larochei (Powell, 1926)
Melagraphia aethiops (Gmelin, 1791)*
Diloma nigerrima (Gmelin, 1791)*
Diloma (Fractarmilla) subrostrata subrostrata
(Gray, 1835)*
Diloma (Fractamilla) hicaniculata lenior (Finlay, 1927)
Cantharidus purpureus (Gmelin, 1791)*
Micrelenchus sanguineus (Gray, 1843)
Cantharidella tessellata (A. Adams, 1851)
Fossarina rimata (Hutton, 1884)
Trochus (Thorista) viridis Gmelin, 1791*
Thoristella oppressa (Hutton, 1878)
Antisolarium egenum (Gould, 1849)
Calliostoma (M.) pellucidum (Valenciennes, 1846)*
Calliostoma (M.) punctulatum (Martyn, 1784)*
Calliostoma (M.) osbornei Powell, 1926*
Turbo smaragdus Gmelin, 1791*
Astraea heliotropium (Martyn, 1784)*
Cookia sulcata (Gmelin, 1791)*
Dollicrossea vesca Finlay, 1927
Nerita (Melanerita) atramentosa (Reeve, 1855)*

CALLIOSTOMATIDAE

TURBINIDAE

CYCLOSTREMATIDAE
NERITIDAE

LITTORINIDAE	<i>Nodilittorina antipodum</i> (Philippi, 1847)
	<i>Nodilittorina cincta</i> (Quoy & Gaimard, 1833)
	<i>Rissellopsis varia</i> (Hutton, 1873)
EATONIELLIDAE	<i>Eatoniella flammulata</i> (Hutton, 1878)
	<i>Eatoniella olivacea</i> (Hutton, 1882)
	<i>Eatoniella roseocincta</i> (Suter, 1908)
RISSOIDAE	<i>Pusillina (Haurakia) hamiltoni</i> (Suter, 1898)
	<i>Rissoina chathamensis</i> (Hutton, 1873)
	<i>Fictonoba carnea</i> (Webster, 1905)
	<i>Merelina lyalliana</i> (Suter, 1898)
	<i>Merelina taupoensis</i> Powell, 1939
TURRITELLIDAE	<i>Maoricolpus roseus roseus</i> (Quoy & Gaimard, 1834)*
VERMETIDAE	<i>Strophopoma roseum</i> (Quoy & Gaimard, 1834)
SILICULARIIDAE	<i>Tenagodus weldii</i> (Tenison Woods, 1876)
POTAMIDIDAE	<i>Zeacumantus</i> sp.
CERITHIOPSIDAE	<i>Seila (Lyrosetia) cincta</i> (Hutton, 1886)
	<i>Cerithiopsis powelli</i> Marshall, 1978
	<i>Zaclys murdochi</i> Marshall, 1978
	<i>Synthopsis caelata</i> (Powell, 1930)
	<i>Prolixodens infracolor</i> (Laseron, 1951)
CALYPTRAEIDAE	<i>Crepidula profunda</i> (Hutton, 1873)
	<i>Crepidula monoxyla</i> (Lesson, 1831)*
TRIVIIDAE	<i>Trivia (Ellatrivia) merces</i> (Iredale, 1924)
NATICIDAE	<i>Tanea zelandica</i> (Quoy & Gaimard, 1832)
MURICIDAE	<i>Xymene traversi</i> (Hutton, 1873)
	<i>Dicathais orbita</i> (Gmelin, 1791)*
	<i>Lepsiella scobina</i> (Quoy & Gaimard, 1833)
	<i>Agnestia tritoniformis</i> (Blainville, 1833)
COLUMBELLIDAE	<i>Paxula paxillus</i> (Murdoch, 1905)
	<i>Zemitrella stephanophora</i> (Suter, 1908)
	<i>Zemitrella</i> spp. [3]
	<i>Macrozafra</i> sp.
	<i>Liratilia</i> sp.
BUCCINIDAE	<i>Cominella adpersa</i> (Brugière, 1789)*
	<i>Cominella maculosa</i> (Martyn, 1784)*
	<i>Cominella virgata virgata</i> (H. & A. Adams, 1853)*
	<i>Austrofusus chathamensis</i> Finlay, 1928*
	<i>Buccinulum linea linea</i> (Martyn, 1764)
	<i>Buccinulum linea fuscozonatum</i> (Suter, 1908)
	<i>Buccinulum colensoi</i> (Suter, 1908)*
	<i>Taron dubius</i> (Hutton, 1878)
FASCIOLARIIDAE	<i>Austromitra rubiginosa</i> (Hutton, 1873)
MITRIDAE	<i>Haluginella mustelina</i> (Angus, 1871)
MARGINELLIDAE	<i>Mesoginella</i> sp. (cf. <i>vailei</i> Powell, 1932)
	<i>Dentimargo cairoma</i> (Brookes, 1924)
TURRIDAE	<i>Aoteadrillia rawitensis</i> (Hedley, 1922)
	<i>Neoguraleus lyallensis tenebrosus</i> (Powell, 1926)
	<i>Neoguraleus sinclairi</i> (Gillies, 1882)
	<i>Neoguraleus murdochi</i> (Finlay, 1924)
	<i>Neoguraleus</i> sp.
	<i>Liracraea odhneri odhneri</i> Powell, 1942
TEREBRIDAE	<i>Pervicacia tristis</i> (Deshayes, 1859)
ARCHITECTONICIDAE	<i>Philippia lutea</i> (Lamarck, 1882)

EPITONIIDAE	<i>Epitonium (Acutiscala) minora</i> (Iredale, 1936)
	<i>Epitonium (Hyaloscala) jukesianum</i> (Forbes, 1852)
TRIPHORIDAE	<i>Sagenotriphora ampulla</i> (Hedley, 1902)
	<i>Nototriphora aupouria</i> Powell, 1937
PYRAMIDELLIDAE	<i>Turbonilla</i> sp.
	<i>Odostomia</i> sp.
ACETONIDAE	<i>Pupa kirki</i> (Hutton, 1873)
SIPHONARIDAE	<i>Siphonaria zelandica</i> Quoy & Gaimard, 1833*
TRIMUSCULIDAE	<i>Gadinalea conica</i> (Angus, 1867)
VALLONIIDAE	<i>Vallonia excentrica</i> (Sterki, 1893) [a small introduced land-snail]

I gratefully acknowledge the help of Bruce Marshall for identification of many of these species.

-oOo-

A SPECTACULAR COLOUR VARIANT OF *Asteracmea suteri*

By Ian Townsend

How molluscs produce their intricate colour patterns is a fascinating subject. Think of the fine detail in some *Powelliphanta* species or the striking colours of cowries - the colours always (within limits) the same for each species. The mantle has an amazingly complex job to do!

Having recently ploughed my way through several litres of shell sand from Mahia Peninsula, my eyes were beginning to glaze over, when all of a sudden a brilliant flash of gem-like colour jolted my senses fully awake. I zoomed up the magnification on the microscope to have a better look. Bright blue-green, peacock-like spots ringed in blood red. You must think I'm joking, but no, I'm not exaggerating the brilliance of the colours! Only small, of course, they were spots scattered within the normally purplish bands on the tiny limpet *Asteracmea suteri* (Iredale, 1915), which in itself is only about 3 to 4 mm long. But I noticed the star-shaped radial bands on this specimen were grey instead of purplish, and then I thought if you evenly mixed in the colours of the spots, namely the red and peacock blue you would finish up with the normal purplish bands. It was as if the colour-producing glands had hiccupped, and splashed out the raw colours, unmixed! I have no idea whether this would really be the case, but it gives an interesting way of thinking about shell colour patterning and mixing of the pigments. Has anyone else noticed this?

-oOo-

CHATHAM ISLANDS VISITS - PART III: 1996-1997

By John Marston

Our first Club visit to the Chatham Islands in January 1994 is fully recorded in *Cookia* Vol. 7 No. 3 (1996), with contributions from those who took part and the added bonus of our Club Patron Dr R.K. Dell, and our Editor Elliot W. Dawson, who were part of the 1954 Chatham Islands Expedition, contributing articles about that expedition. I reported subsequently the results of two other trips by club members in 1996 and 1997 (Marston, 1997).

The first report from the Chatham Islands 1954 Expedition was some new descriptions and records by Dell (1956a). This was followed by the major work describing species mostly from depths greater than 100 fathoms (Dell, 1956b), an inclusion of the Chathams scaphopods in a New Zealand-wide revision (Dell, 1957a), and a preliminary notice of the expedition results (Dell, 1957b).

Dell's definitive contribution to the "Biological Results of the Chatham Islands 1954 Expedition" series (Dell, 1906) encompassed marine species found generally in less than 100 fathoms.

Between 1960 and 1994 there had been so many name changes that it was worth preparing a parallel checklist, preserving the 1960 information but indicating new names, based largely upon Powell's 1979 "New Zealand Mollusca," and Beu and Maxwell's 1990 "Cenozoic Mollusca of New Zealand."

Already the Chathams checklist prepared after our 1994 visits (Marston, 1996) is outmoded, though strangely some species have reverted to earlier names.

This new 1998 checklist is based upon the following authorities -

- (1) Spencer & Willan's new New Zealand checklist (Spencer & Willan, 1996);
- (2) B.A. Marshall's revision of N.Z. Calliostomatinae (Marshall, 1995);
- (3) Nukumaruan/Recent names in "Cretaceous-Cenozoic Geology & Biostratigraphy of the Chatham Islands, N.Z." (Campbell *et al.*, 1993). I was not aware of this book at the time of compiling my previous checklist. In particular *Austrofusus*, *Xymene*, *Pecten* and *Chlamys* are affected.

CODE TO MARKS USED IN THE FOLLOWING CHECKLIST -

11-53 Extreme left, page numbers in strict sequence following Spencer & Willan; (bold type, e.g. 53).

22-445 Right of S & W, page numbers, now longer sequential, from Powell 1979.

† Cenozoic Mollusca of NZ, Beu & Maxwell, 1990, e.g. †314.

‡ Cretaceous Cenozoic geology of Chatham Is, Campbell *et al.* 1993.

§ Revision of N.Z. species of *Calliostoma*, B. A. Marshall, 1995.

[] Square brackets e.g. [214] indicate Powell's 1979 page number for ease of reference where a new name is used.

* A new addition to Chatham Islands molluscan fauna since Dell's 1960 list. Difficult micromolluscan species are claimed only if first identified by B.A. Marshall.

E Generally considered to be endemic to Chathams. This list appears to be decreasing.

F1 Only in Dell's 1960 list - refers to a species recorded by Finlay (1928) but by no one else. We substantiated 3 of his records in 1994. Finlay did not visit the Chatham himself but wrote up earlier collections, notably those of the 1924 Otago University Expedition.

"Widespread" has been used to describe a species which occurred at every location we visited, either living there or cast ashore from the approximate locality. In my Chatham Islands 1994 checklist (Marston, 1996) each locality was specified, but with further visits in 1996 and 1997 and further localities added it made the repetition too unwieldy and unnecessary for the common species. Te Whanga lagoon, virtually landlocked, is the one exception, and the approximately ten species which live in there have been recorded separately.

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COMPARATIVE LIST OF CHATHAMS MOLLUSCAN RECORDS

		1998	1960
11	22	<i>Ischnochiton maorianus</i> Iredale, 1914 W2 W3 W5 W37	- C11 C26 C49 P13 (0)
11	*24	<i>Callochiton kapitensis</i> Mestayer, 1926 W39 W43	- -
11	26	<i>Plaxiphora biramosa</i> (Q. & G., 1835) W2 W10	<i>Diaphoroplax biramosa</i> C22 C26 P15 (0)
11	-	<i>P. boydeni</i> Murdoch, 1982 <i>fide</i> Spencer & Willan 1996: 11 C F M An	- -
11	26	<i>P. caelata</i> (Reeve, 1847) widespread, even in Te Whanga lagoon	<i>Maorichiton schauinslandi</i> Thiele, 1909 C16 C26 C39 P2 (0)
-	-	<i>Plaxiphora</i> sp. ? W39 (alive)	- -
11	*28	<i>Rhyssoplax canaliculatus</i> (Q & G., 1835) W39	- -
11	28	<i>Sypharochiton pelliserpentis</i> (Q. & G., 1835) W6 W10 W27	- C9 C22 C26 C49 D4 P15 (0)
11	29	<i>Onithochiton neglectus</i> Rochbrune, 1881 W6 W10 W26 W27	- C11 C26 C39 C43 C49 P15 (0) = <i>Iscoplax chathamensis</i> Dell, 1960 C14 C16 C18
11	[28]	Powell 1979 lists this as <i>Rhyssoplax (Nodioplax) chathamensis</i> Dell, 1960	
12	30	<i>Acanthochitona (N.) facilis</i> (Iredale & Hull, 1931) (<i>fide</i> Beu 1977: 53, but not in Powell 1979 from the Chathams)	-
12	31	<i>A. (N.) rubiginosa</i> (Hutton, 1872) W12	<i>Craspedochiton rubiginosus</i> C24 (38)
12	31	<i>A. (N.) violacea</i> (Q. & G., 1835) W10 W39	<i>Notoplax violacea</i> C26 C49 P15 (0)
12	31	<i>Cryptoconchus porosus</i> (Burrow, 1815)	- C26 P15 (0)
12	41E	<i>Cellana strigilis chathamensis</i> (Pilsbry, 1891) widespread	- C9 C11 C16 C26 C49 D4 P15 (0)
12	48	<i>Notoacmea parviconoidea</i> (Suter, 1917) W6	- P4
12	45	<i>Radiacmea inconspicua</i> (Gray, 1843) widespread	- C11 C13 C16 C26 C38 C46 P15 (0-43)
13	38	<i>Incisura lytteltonensis</i> (E.A. Smith, 1894) W26	- C11 C16 P1 (0)
13	35	<i>I. rosea</i> (Hedley, 1904) W12	<i>Scissurona rosea</i> (Hedley, 1904) C16 P1 (0)
13	*34	<i>Scissurella fairchildi</i> Powell, 1933 W12 W26	- -
13	34E	<i>S. predrevillei</i> Powell, 1933 W12	- P5 (10)
13	34	<i>Sinezona brevis</i> (Hedley, 1904)	- P5 (10)

- 13 *34 *S. iota* (Finlay, 1926)
W12
- 13 34 *S. laqueus* (Finlay, 1926)
W12 *Schismope laqueus* (Finlay, 1926)
C16 C23 P5 (0-33)
- 13 35 *S. levigata* (Iredale, 1908)
W12 *S. laevigata* (Iredale, 1908)
C13 C16 P1 (0-5)
- 13 35E *S. pauperata* Powell, 1933
W9 W26 P5 (10)
- 13 35 *S. cf. subantarctica* (Hedley, 1916)
F1 *S. cf. antarctica* (Hedley, 1916)
- 13 36 *Haliotis iris* Gmelin, 1791
widespread C9 C49 P15 (0)
- 13 36 *H. australis* Gmelin, 1791
widespread C9 C16 D4 P15 (0)
- 13 37E *H. virginea morioria* Powell, 1938
widespread (W4, alive, Don Watson) C11 C14 C16 C18 C26 P15 (0-15)
- 13 38 *Emarginula striatula* (Q. & G., 1834)
widespread C14 C16 C23 C24 C28 C31 C38 C49
P14 (0-50)
- 13 38 *Montfortula rugosa* (Q. & G., 1834)
widespread *M. chathamensis* Finlay, 1928
C9 C11 C16 C22 (0)
- 14 40 *Tugali suteri suteri* (Thiele, 1916)
widespread C16 C26 C49 P1 (0)
- 14 40 *T. cf. elegans* Gray, 1843
W31 (cod stomach, 35 fathoms) C14 C23 C24 (15-38)
- 14 41E *Monodilepas skinneri* Finlay, 1928
W6; W17 (March 1996, Don Watson) C11 C14 C16 C38 P6 (0-43)
- 14 54E *Cantharidus opalus cannoni* Powell, 1933
widespread C11 C16 P15 (0)
- 14 53 *Diloma arida* (Finlay, 1927)
W6 W17 W27 *Zediloma arida* Finlay, 1927
C9 C16 C49 P2 (0)
- 14 53 *D. nigerrima* (Gmelin, 1791)
widespread *Z. digna* Finlay, 1927
C9 P2 (0)
- 14 51E *Margarella fulminata* (Hutton, 1873)
widespread C11 C12 C16 P15 (0)
- 14 53 *Melagraphia aethiops* (Gmelin, 1791)
W6 W17 W20 W21 C9 C16 C49 D4 P2 (0)
- 14 56E *Micrelenchus caelatus morioria* Powell, 1933
widespread C11 C13 C14 C20 C24 C31 C38
P5 (0-43)
- 14 56 *M. dilatatus* (Sowerby, 1870)
widespread C11 C16 C46 C49 P15 (0-3)
- 14 57 *M. tenebrosus* (A. Adams, 1853)
F1 *M. tenebrosus tenebrosus* (A. Adams)
F1 *M. tenebrosus huttoni* (E.A. Smith, 1876)
F1
- 14 59E *Thoristella chathamensis* (Hutton, 1873)
widespread C9 C13 C16 C24 C38 C49 P15 (0-43)
- 14 58 *Trochus tiaratus* (Q. & G., 1834)
F1 *Trochus huttoni* Cossman, 1918
- 14 58 *T. viridis* Gmelin, 1791
widespread C11 C16 C26 P15 (0)

- §90 *Calliostoma (M.) granti* (Powell, 1931)
[62]
- [62] widespread
- 14 §108 *C. (M.) selectum* (Dillwyn, 1817)
[61] W30 + W9
("piece", P. Lakeman in *Cookia* 8: 6)
- 15 §84 *C. (M.) tigris* (Gmelin, 1791)
[61] widespread
- 15 §112 *C. (M.) waikanae* Oliver, 1926
[62] W30 W31 W33 + W6 (*Cookia* 8: 6)
- 15 78 *Brookula (A.) finlayi* Powell, 1933
- 15 78 *B. (Liotella) polypheura* (Hedley, 1904)
W12 W26
- 15 52 *Herpetopoma bella* (Hutton, 1873)
widespread
- 15 52 *H. larochei alacerrima* Dell, 1956
- 15 65 *Antisolarium egeum* (Gould, 1849)
W6 W26
- 15 †404 *Zethalia zelandica* (H. & J., 1855)
[65] -
- 15 66 *Astraea heliotropium* (Martyn, 1784)
widespread
- 15 66 *Cookia sulcata* (Gmelin, 1791)
very widespread
- 15 †160 *Modelia granosa* (Martyn, 1784)
†404 very widespread
[66]
- 15 67 *Homalopoma (A.) fluctuata* (Hutton, 1873)
W12
- 15 69E *Munditia owengaensis* Powell, 1933
W12 W26
- 16 70 *Cirsonella densilirata* Suter, 1908
W26
- 16 *71 *C. cf. varicostata* Powell, 1940
W12
- 16 *70 *Cirsonella* n. sp.
W39
- 16 73 *Crosseola (D.) vesca* (Finlay, 1926)
W12 W26
- 16 72 *Lodderia eumorpha cookiana* (Dell, 1952)
W12 W32
- 16 76 *Putilla neozelanica* (Suter, 1898)
W12 W39
- 16 *79 *Zalipais benthicola* Powell, 1927
W12
- 16 79 *Z. lixa* (Suter, 1908)
- 17 131 *Zeacumantus subcarinatus* (Sowerby, 1855)
widespread
- Maurea punctata ampla* (Powell, 1939)
"fide Powell" Dell 1960: 145
- M. punctulata stewartiana* (Oliver, 1926)
C11 C14 C26 C29 P6 (0-94)
- M. cunninghami pagoda* (Oliver, 1926)
F1
- M. tigris chathamensis* (Dell, 1950)
C11 C49
- M. pellucida morioria* Powell, 1946
C30 (0-70) + P6 type locality
- C16 P5 (0-10)
- Liotella polypheura*
C11 C16 P1 (0)
- C9 C16 C49 P2 (0)
- C24 (38)
- widespread (0-94)
- Zethalia zelandica* (A. Adams, 1855)
F1
- C18 C24 P6 (0-38)
- C16 D4 P15 (0)
- widespread (0-15)
- Argalista fluctuata*
C11 C23 C24 C38 P1 (0-38)
- Cyclostrema owengaensis* (Powell, 1933)
C13 P5 (5-10)
- C23 C24 (33-38)
- Dolicrossea vesca* (Finlay, 1927)
C16 C32 P1 (0-7)
- C23 (33)
- Notosetia neozelanica* (Suter, 1898)
C20 C23 C38 P1 (0-43)
- P1 (0)
- C11 C16 C49 P15 (0)

17	125	<i>Maoricolpus roseus</i> (Q. & G., 1834)	-
		widespread	C11 C14 C16 C23 C49 P15 (0-33)
17	127	<i>Zeacolpus knoxi</i> Marwick, 1957	-
		W12 W16	C15 C20 C28 C29 (20-94)
17	129	<i>Novastoa lamellosa</i> (Hutton, 1873)	-
		W3 W13 W15 W16 W20	C16 C49 P4 (0)
18	128	<i>Serpulorbis zelandicus</i> (Q. & G., 1834)	-
		W6 W9 W24	C49P4 (0)
18	130	<i>Tenagodus weldii</i> (Tenison-Woods, 1876)	<i>Pyxipoma weldii</i> (Tenison-Woods)
		W12 W26	F1
18	†405	<i>Nodilittorina cincta</i> (Q. & G., 1833)	<i>Melarthaphe cincta</i> (Quoy & Gaimard)
		[87] widespread	C9 C22 D3 P15 (0)
18	[87]	<i>N. antipodum</i> (Philippi, 1847)	<i>M. oliveri</i> Finlay, 1930
		W1 W22 W28	C9 C16 C26 C49 P15 (0)
18	88	<i>Rissellopsis varia</i> (Hutton, 1873)	-
		W21 W26 W36	widespread (0-43)
18	88	<i>Laevilittorina (M.) aucklandica</i> (Powell, 1933)	<i>Macquariella aucklandica</i> Powell
		W12	C11 C13 C16 C32 C38 P1 (0-43)
18	90	<i>Eatoniella albocolumella</i> Ponder, 1965	-
		-	No locality - Ponder 1965a: 57, needs confirmation
18	91	<i>E. atervisceralis</i> Ponder, 1965	-
		-	C16 D3, Ponder 1965a: 75
18	92	<i>E. atropurpurea</i> (Frauenfeld, 1867)	<i>E. minutocrassa</i> Ponder, 1965
		-	C49, Ponder 1965a: 84-85
18	92	<i>E. dilatata</i> (Powell, 1955)	-
		W12	D3 + Red Bluff 1909, Ponder 1965a: 79
18	89	<i>E. kerguelenensis chiltoni</i> (Suter, 1909)	Recorded Powell 1979 from Ponder 1965a:
		-	53, 54. C13 C16 C49 D3. Tioriori
18	92	<i>E. limbata</i> (Hutton, 1883)	<i>Dardanula limbata</i> (Hutton, 1883)
		-	C49 P1 (0)
18	89	<i>E. lutea</i> (Suter, 1908)	-
		-	C49, Ponder 1965a: 57, needs confirmation
18	92	<i>E. mortoni</i> Ponder, 1965	-
		-	D3, Red Bluff, Tioriori, Ponder 1965a: 85
18	91	<i>E. notalabis</i> Ponder, 1965	-
		-	D3 + Red Bluff 1909; Ponder, 1965a: 70
18	92	<i>E. olivacea</i> (Hutton, 1882)	<i>Dardanula olivacea</i>
		W26	widespread
18	94	<i>E. pfefferi</i> (Suter, 1909)	<i>Skenella pfefferi</i> Suter, 1909
		W26	C11 P3 (0); also Ponder 1965a: 97
18	91	<i>E. pullmitra</i> Ponder, 1965	-
		-	D3 + Red Bluff 1909; Ponder 1965a: 72
18	93	<i>E. roseola</i> (Iredale, 1915)	<i>Dardanula roseola</i>
		W12	C23 C38 C49 P5 (0-43); Ponder 1965a: 89
18	93	<i>E. smithi</i> Ponder, 1965	-
		-	C13 C32 C38; Ponder 1965a: 90-91
18	92	<i>E. varicolor</i> Ponder, 1965	-
		-	C49, Ponder 1965a: 73, needs confirmation
18	93	<i>E. verecunda</i> (Suter, 1908)	<i>Notosetia verecunda</i> (Suter, 1908)
		-	P1 (0) Powell 1933: 198, yet not in Powell
		-	1979: 93 from Chathams

- 18 90 *E. (Albosabula) lampra* (Suter, 1908) *Notosetia lampra* (Suter, 1908)
P5 (10); Ponder 1965a: 61-62
- 18 *94 *Pupatonia* cf. *atoma* Ponder, 1965
W26
- 18 94 *P. gracilispira* (Powell, 1933) *Estea gracilispira* Powell, 1933
C16 C23 P5 (0-3)
- 18 116E *Eatonia atomaria* (Powell, 1933) *Notosetia atomaria*
W12 C38 P1 (0-43); Ponder 1965b: 122
- 19 117 *Tubbreva* e. *exaltata* (Powell, 1933) *N. exaltata*
C24 P5 (10-38) + Ponder 1965b: 127
- 19 105 *Anabathron* (*S.*) *hedleyi* (Suter, 1908) *Scrobs hedleyi*
C16 C49 P2 (0)
- 19 †380 *Pisinna insulana porrecta* (Powell, 1933) *Estea porrecta* Powell, 1933
[101] - C13 C15 C20 C23 C38 P1 (0-43);
also Ponder 1965c: 139
Estea cf. *insulana* Marwick, 1928;
P5, Ponder 1965c: 139
- 19 102E *Pisinna micronema morioria* (Powell, 1933) *Estea morioria*
P5 (10), Ponder 1965c: 142
- 19 102 *P. minor* (Suter, 1898) *Estea minor* (Suter, 1898)
C16 C38 C49 P2 (0-43) D3
- 19 101 *P. olivacea impressa* (Hutton, 1885) *Estea impressa*
C38 P5 (10-43)
- 19 102 *P. rekohuana rekohuana* (Powell, 1933) *Estea rekohuana*
C13 C16 C32 C38 C49 P2 (0-43) D3
- 19 102 *P. subfusca subfusca* (Hutton, 1873) *Estea guesti* Powell, 1933
W47 C13 C16 C32 C38 C49 P1 (0-43);
D3, Ponder 1965c: 155
- 19 107 *Fictonoba carnosus martini* (Finlay, 1928) *Austronoba martini* Finlay, 1928
widespread (0-43)
- 19 †378 *Alvania* (*L.*) *maclurigi* (Powell, 1933) *Linemera maclurigi* Powell, 1933
[97] W12 C20 C23 C38 P5 (10-43)
- 19 108 *Merelina foliata* (Suter, 1908) *Anabathron foliatum* (Suter, 1908)
W12 C16 P5 (0-10)
- 19 109 *M. maoriana* Powell, 1939
W12 W26 C13 C16 C31 C32 C38 P1 (0-43)
- 19 109 *M. plaga* Finlay, 1926
W12 Finlay 1928: 141 + Powell 1933: 185, but
not in Dell 1960 nor Powell 1979
- 20 109E *M. waitangiensis* Powell, 1933
W26 P1 (0)
- 20 112 *Onoba fumata* (Suter, 1898) *Subonoba fumata*
C16 P1 (0)
- 20 112E *O. inornata* (Powell, 1933) *Subonoba inornata*
W12 C16 P2 (0)
- 20 112E *O. morioria* (Powell, 1933) *Subonoba morioria*
W12 C13 C16 P1 (0-6)
- 20 112E *O.* cf. *paucicostata* (Powell, 1931) *Subonoba* cf. *paucicostata*
P1 (0)
- 20 100 *Onoba* (*Ovirissoa*) *lubrica* (Suter, 1898) *Notosetia lubrica* (Suter, 1898)
In Marston 1996: 22 appears (as per
Powell 1979: 100) as *Rissopsis*
(*Peringiella*) *lubrica* (Suter) P5 (10), but not in Powell 1979: 100 as
at Chathams

20	99	<i>Powellisetia subtenius</i> (Powell, 1937)	-
		W12	Not in Dell 1960, but in Powell 1979:
		Not in 1996 checklist	99-100 as at Chathams
20	†380	<i>Pusillina</i> (<i>H.</i>) <i>hamiltoni</i> (Suter, 1898)	<i>Haurakia hamiltoni</i>
	[95]	-	C13 C32 P1 (0-43)
20	[95]	<i>P. (H.) infecta</i> (Suter, 1898)	<i>Notosetia infecta</i>
		W12	C16 C38 P1 (0-4)
20	106	<i>Rissoina chathamensis</i> (Hutton, 1873)	-
		widespread	C9 C11 C16 C38 C49 P1 (0-43)
21	74	<i>Elachorbis sublatei</i> (Suter, 1907)	-
		W12	C13 C28 (4-50)
21	128	<i>Caecum digitulum</i> Hedley, 1904	-
		W12 W26	C16 P2 (0)
21	146	<i>Leptonotus perplexus</i> (Suter, 1907)	<i>Neojanicus perplexus</i> Suter, 1907
		-	C15 C28 C29 (30-94)
21	148	<i>Sigapatella novaezelandiae</i> (Lesson, 1831)	-
		widespread	C13 C16 C31 C38 C49 P15 (0-43)
21	148	<i>Zegalerus crater</i> Finlay, 1926	-
		non-beach, only in Moutapu Point	F1. Possibly derived fossil, Powell 1979: 148
		fossil bed (Nukumaruan)	
21	149	<i>Z. tenuis</i> (Gray, 1867)	-
		W6	C28 C29 (50-94)
21	146	<i>Malluvium calcareum</i> (Suter, 1909)	<i>Capulus calcareus</i>
		-	C29 (94)
21	147	<i>Trichosirius inornatus</i> (Hutton, 1873)	<i>T. inornatus chathamensis</i> Finlay, 1928
		W6 W26 W36	C15 P1 D1 (0-30)
22	152	<i>Trivia</i> (<i>E.</i>) <i>merces</i> (Iredale, 1924)	<i>Ellatrivia memorata</i> Finlay, 1927
		-	F1 (needs confirmation)
22	*150	<i>Lamellaria cerebroides</i> Hutton, 1883	-
		W6	-
22	154	<i>Tanea zelandica</i> (Q. & G., 1832)	-
		widespread	widespread (0)-94)
22	156	<i>Uberella vitrea</i> (Hutton, 1873)	-
		W6	C12 C15 C20 C23 C28 C29 P1 (0-94)
22	†353	<i>Semicassis pyrum</i> Lamarck, 1822	<i>Xenophalium powelli</i> Finlay, 1928
	[159]	W17	P10 (0)
22	[160]	<i>S. pyrum</i> Lamarck, 1822	<i>X. finlayi</i> Powell, 1927
		W30 W32 W33	C29 (94)
22	†410	<i>Argobuccinum pustulosum tumidum</i>	<i>A. tumidum</i> (Dunker, 1862)
	[166]	very widespread, incl. The Forty Fours	C11 C23 C24 D1 P6 (0-38)
22	[167]	<i>Fusitriton magellanicus laudandus</i>	<i>F. laudandus</i> Finlay, 1927
		W5 W29 W43: W 16 (1996)	C29 (94)
		[W5 and W16 both beach shells]	
22	†167*	<i>Ranella australasia</i> (Perry, 1811)	-
		(forma <i>blacki</i> Powell, 1954)	-
		W30 (trawled live) W 16 (first beach record, 1996)	-
23	†167*	<i>R. olearium</i> (Linnaeus, 1758)	-
		shelf edge off Kaingaroa, trawled live March 1996	-
23	164	<i>Cabestana spengleri</i> (Perry, 1811)	-
		very widespread and common	C11 D1 P4 (0)
23	†354	<i>C. tabulata</i> (Menke, 1843)	<i>C. waterhousei segregata</i> Powell, 1933
	[164]	W6 W23	P6 (0)

23	*168	<i>Charonia lampas rubicunda</i> (Perry, 1811)	-
		W6 W16 W30 W33 W41 (Forty Fours)	-
23	134	<i>Alipta crenistria</i> (Suter, 1907)	-
			C37 (30)
23	*[133]	<i>Mendax trizonalis odhneri</i> (Powell, 1927)	-
		W30 (off The Forty Fours)	-
		[<i>Specula odhneri</i> in Powell 1979: 133]	-
24	136	<i>Seila</i> (<i>Lyroseila</i>) <i>cincta</i> Hutton, 1866	<i>Lyroseila chathamensis</i> (Suter, 1908)
		W21 W26 W27 W36	C16 C23 C49 P1 (0-33)
24	256	<i>Teretriphora huttoni</i> (Suter, 1908)	<i>Notosinister huttoni</i>
		W40	P5 (10)
24	252	<i>Cirsotrema forrestr</i> Dell, 1956	-
			C29 (94)
24	254	<i>Janthina exigua</i> Lamarck, 1822	-
		W21 W47 (both March 1996)	D1 P1 (0)
24	254	<i>J. janthina</i> (Linnaeus, 1758)	-
		W21 (March 1996)	D1 (0)
25	137	<i>Larochella alta</i> Powell, 1927	-
		W12	C16 P5 (0-10)
25	*137	<i>L. cf. toreuma</i> Powell, 1927	-
		W12	-
25	*139	<i>Fusceulima murdochi</i> (Hedley, 1904)	-
		W15	-
25	*106	<i>Scalaronobac</i> <i>costata</i> Powell, 1927	-
		W12	-
25	†328	<i>Melanella aucklandica</i> (Suter, 1909)	<i>Balcis archevi</i> (Finlay, 1928)
		[139] W26	C13 C16 P1 (0-6)
25	170	<i>Poirieria zelandica</i> (Quoy & Gaimard, 1833)	-
		W6 W30	C28 C30 P6 (0-70)
25	177	<i>Terefundus</i> (<i>M.</i>) <i>crassiliratus</i> (Suter, 1908)	-
			C16 C20 (0-20)
26	174	<i>Xymene ambiguus</i> (Philippi, 1844)	<i>Zeatrophon ambiguus</i>
		W6 W30 W33	C11 C24 C49 P6 (0-48)
-	‡158	<i>X. mutabilis</i> (Marwick, 1928)	<i>Z. mutabilis</i> synonymised with <i>X. ambiguus</i>
		*[174] W6, but derived Nukumaruan fossil (not on Owenga Shelly Sand table 4.33, Campbell <i>et al.</i>)	by Ponder 1972: 486, but reinstated by Beu in Campbell <i>et al.</i> 1993: 158
26	174	<i>X. mortenseni caudatinus</i> (Finlay, 1930)	<i>Zeatrophon caudatinus</i>
		W33	C28 C29 (50-94)
26	173	<i>X. plebeius</i> (Hutton, 1873)	<i>Zeatrophon plebejus</i>
		W6	F1 [we confirmed this at one beach]
26	174	<i>X. pulcherrimus</i> (Finlay, 1930)	"94 fathoms Petre Bay" <i>fide</i> Ponder 1972: 488
26	175	<i>X. converus</i> (Suter, 1909)	"Chatham Is. 12 F. - 120F" <i>fide</i> Powell 1979: 175
			-
26	175	<i>X. traversi</i> (Hutton, 1873)	<i>Arymene traversi</i>
		very widespread	widespread (0-43)
26	180	<i>Haustrum haustorium</i> (Gmelin, 1791)	-
		very widespread	C9 C16 C26 C49 D4 P2 (0)
26	180	<i>Lepsiella scobina</i> (Q. & G., 1833)	<i>L. scobina scobina</i> (Q. & G., 1833)
		W14 W15 W17 W36	2C9 C16 P6 (0)
26	180	<i>L. albomarginata</i> (Deshayes, 1839)	<i>L. scobina albomarginata</i> (Deshayes)
		W6 W22	C11 C26

- 26 180 *Lepsithais lacunosus* (Bruguière, 1789) *L. squamatus* (Hutton, 1878)
widespread (2 live, Okahu Point 1996) C11 C16 C22 C26 P6 (0)
- 26 179 *Dicathais orbita* (Gmelin, 1791) *Neothais scalaris* (Menke, 1829)
W6 W16 W23 W24 P6 (0)
- 26 ‡160 *Austrofusus glans* [forma] *glans* (Röding, 1798) *A. glans* (Bolten, 1798)
[197] W6 W16 C11 C28-C31 C38 (0-94)
- 26 ‡160 *A. glans* [forma] *chathamensis* Finlay, 1928 *A. chathamensis* Finlay, 1928
very widespread C11 C49 P6 (0)
- 26 198 *Buccinulum linea linea* (Martyn, 1784) *B. (Evamnula) charakteristica* (Finlay, 1928)
W10 W17 W21 W36 W49 C11 C14 C16 P15 (0-15)
[*B. linea linea* (Martyn, 1784) *B. waitangiensis* Powell, 1933
W2 W4 W10 W21 W38] C9 C11 C26 C49 P1 (0)
- 26 198 *B. linea flexicostatum* Dell, 1956
W39 W49 C29, type locality, Dell 1956b: 102
[not in Dell 1960 list]
- 27 *198 *B. finlayi* Powell, 1929
W31 W33 -
- 26 198 *B. pallidum pallidum* Finlay, 1928
W6 W17 W49 C49
- 26 198 *B. pertinax* (Martens, 1878)
W6 W11 *B. (Evamnula) marwicki* (Finlay, 1928)
C16 C26 P15 (0)
- 27 199E *B. vittatum bicinctum* (Hutton, 1873)
widespread *B. (Euthrena) bicinctum* (Hutton, 1873)
widespread (0-15)
- 27 192 *Cominella adspersa* (Bruguière, 1789)
W1 W2 W6 *C. (Acominia) adspersa*
C11 C43 C49 P15 (0-4)
- 27 192 *C. maculosa* (Martyn, 1784)
W2 W6 W23 W24 W33 C9 C11 C16 C26 C49 P15 (0)
- 27 193 *C. (Josepha) glandiformis* (Reeve, 1847)
W6 *C. (Cominista) glandiformis*
C33 P6 (0)
- 27 195E *C. (Eucominia) nassoides iredalei* (Finlay, 1928) *C. (E.) iredalei* (Finlay, 1928)
widespread on northern and eastern sides only, C11 C14 P6 (0-15)
live 15-35 fathoms, crayfish pots and trawl
- 27 195E *C. (E.) nassoides ellisoni* *C. (E.) ellisoni consobrina* Powell, 1933
W6, derived beach fossil. Nukumaruan; P6 (0)
merely extreme range of Marwick's
fossil *ellisoni*
- 27 195E *C. (E.) mirabilis canturiensis* (Dell, 1951) *Fax mirabilis nuptialis* Dell, 1953
C29 (94)
- 27 201E *Penion chathamensis* Powell, 1938
W30 -
- 27 189E *Liratilia conquistia chathamensis* Dell, 1956
W12 "Kaingaroa" (Dell 1960: 147, after Powell)
- 28 188 *Macrozafra subabnormis* (Suter, 1899) *M. subabnormis saxatilis* (Murdoch, 1905)
[forma *saxatilis* - Powell 1979: 188] C23 C24 (33-38)
W26 C49 P1 (0)
- 28 *188 *M. cf. nodicincta* (Suter, 1899)
W6 -
- 28 183 *Paxula allani* Finlay, 1928
W15 W21 W26 W36 C16 C19 P15 (0)
- 28 184 *P. subantarctica subantarctica* (Suter, 1908)
W12 W15 W26 P15

28	183E	<i>Zemitrella finlayi</i> Powell, 1933	-
		W15 W26	C13 C16 C23 C32 C49 P1 (0-33)
28	209	<i>Alcithoe wilsonae</i> (Powell, 1933)	<i>Pachymelon (Palomelon) wilsonae</i>
		W16 W32 W50 (Don Watson, 1966)	P6 (0)
		‡158* W6, 3 beach specimens, derived Nukumaruan fossil	
28	213*	<i>Provocator mirabilis</i> (Finlay, 1926) [formerly <i>Iredalina</i>]-	
		W16 (first recorded beach specimen)	
28	218	<i>Haluginella albescens</i> (Hutton, 1873)	<i>Marginella (Volvarina) albescens</i> Hutton
		-	C23 C24 (33-38)
28	220	<i>Sinuginella pygmaea</i> (Sowerby, 1846)	<i>Marginella (Glabella) pygmaea</i> Sowerby
		-	P1 (0)
28	222	<i>Volvarinella cairoma</i> (Brookes, 1924)	<i>M. (Volvarinella) aoteana</i> Powell, 1932
		W21	C23 P2 (0-33)
		[<i>V. cairoma</i>]	<i>M. (Volvarinella) cairoma</i> Brookes, 1924
		W26 W28	C16 C32 P2 (0-7)
29	214	<i>Volutomitra banski</i> (Dell, 1951)	<i>Proximitra banski</i> Dell, 1951
		-	C29 (94)
29	216	<i>Austromitra rubiginosa</i> (Hutton, 1873)	-
		widespread	C11 C14 C156 C49 P15 (0-15)
29	225*	<i>Oamaruia (Zeadmete) cf. trailli</i> (Hutton, 1873)	-
		W3	-
30	234	<i>Phenatoma rosea</i> (Q. & G., 1833)	<i>P. novaezealandiae</i> (Reeve, 1843)
		-	C28 (50)
30	244*	<i>Nepotilla cf. powelli</i> Dell, 1956	Type locality at 130 fathoms, so outside of
		W12 (30-35 fathoms)	Dell's 1960 list
30	240	<i>Antiguraleus otagoensis</i> Powell, 1942	-
		-	C29 (94)
30	241	<i>Liracraea otakauica</i> Powell, 1942	-
		W26	C28 (50)
30	241	<i>L. odhneri odhneri</i> Powell, 1942	-
		-	C49 (0)
30	*241	<i>L. epentromac cf. whangaroensis</i> (Murdoch, 1905)	-
		W12	-
30	238	<i>Neoguraleus murdochi</i> (Finlay, 1924)	-
		widespread	C16 C49 (0) [not listed by Powell, 1979: 238,
			238, nor by Spencer & Willan, 1996: 30]
30	+420	<i>Neoguraleus sinclairi</i> (Gillies, 1882)	-
		[238] W47 (March 1996)	P1 [not listed by Dell, 1960: 147, but in
			Powell, 1979: 238]
31	118	<i>Orbitestella hinemoa</i> Mestayer, 1919	-
		W12	P1 (0)
31	118	<i>Orbitestella toreuma</i> Powell, 1930	-
		W26	C16 C23 P1 (0-33)
31	*137	<i>Brookesena neozelanica</i> (Suter, 1908)	-
		W39 (1996)	-
31	137	<i>Brookesena succincta</i> (Suter, 1908)	-
		W39	C16 (0)
31	119	<i>Rissoella elongatospira</i> Ponder, 1966	-
		-	C49 D3 (Ponder, 1966: 168)
31	120	<i>R. (?) flemingi</i> Ponder, 1968	-
		-	"Kaingaroa" (Ponder, 1968: 121)

31	120	<i>Rissoella (Jeffreysiella) rissoaformis</i> (Powell, 1939)	<i>Zelaxitas fiordlandica</i> Fleming, 1948 C16 Not listed Powell, 1979, Ponder, 1966
31	120	<i>R. (Zelaxitas) cystophora</i> (Finlay, 1924)	<i>Zelaxitas cystophora</i> (Finlay, 1924) C11 (0) + D3 (Ponder, 1966: 170)
31	120	<i>R. (Z.) micra</i> (Finlay, 1924)	<i>Zelaxitas micra</i> (Finlay, 1924) C11 C16 P1 (0)
31	120	<i>Omalogyra fusca</i> Suter, 1908 W12 W26	- C11 (0)
32	265	<i>Agatha georgiana</i> (Hutton, 1885) W26	- C29 (94)
32	266E	<i>Besla waitangiensis</i> Laws, 1941	- C16 (0)
32	265	<i>Evalea sabulosa</i> (Suter, 1908) W12 P1 (Powell 1933: 185, not in Powell 1979: 265, nor Dell 1960)	-
32	264	<i>Gumina dolichostoma</i> (Suter, 1908)	- C13 C20 C23 (4-33)
32	265	<i>Linopyrga rugata rugata</i> (Hutton, 1886)	- C11 C13 C16 C38 (0-50)
32	263	<i>Odostomia cryptodon</i> Suter, 1908	- recorded by only by Laws (1939: 206) as "a worn shell" - needs confirmation
32	263	<i>O. incidata</i> Suter, 1908	- C11 C15 C28 C29 (0-94)
32	264	<i>O. vaga</i> Laws, 1939	- C11 C16 (0)
32	267E	<i>Siogamaia morioria</i> Laws, 1941	- C13 C49 (0-6)
32	258	<i>Chemnitzia campbelli</i> (Odhner, 1924)	- C16 C20 C49 (0-20)
32	259	<i>C. mitis</i> Laws, 1937	- P5 [= <i>C. n. sp.</i> , Powell 1933: 186, 204]
32	258E	<i>C. owenga</i> Laws, 1937 W39	- C31 (0-22)
32	259	<i>Striarcana cryptolira</i> Laws, 1937	- C13 C16 D1 (0)
32	256	<i>Turbonilla moorei</i> Laws, 1937	- C28 C29 (50-94)
33	276	<i>Retusa oruaensis</i> (Webster, 1908)	- C13 C16 C23 C28 C38 P1 (0-50)
33	277	<i>Cyllichnina striata</i> (Hutton, 1878) W26	- C16 C20 C32 P1 (0-20)
33	272	<i>Philine constricta</i> Murdoch & Suter, 1906	- C29 P5 (10-94)
33	280	<i>Aplysia juliana</i> (Q. & G., 1832)	<i>A. brunnea</i> Hutton, 1875 F1 (requires confirmation)
34	278	<i>Cavolinia tridentata</i> (Forskål, 1775)	<i>C. telemus</i> (of authors, not Linnaeus, 1758) C30 (70)
35	282	<i>Berthella medietas</i> Burn, 1962	<i>Bouvieria aurantiaca</i> Powell, in part, not Risso
35	282	<i>B. ornata</i> (Cheeseman, 1878)	<i>Bouvieria ornata</i> Cheeseman, 1878 P6 (0)

- 35 284 *Archidoris wellingtonensis* (Abraham, 1877)
W18 field identification, Dell 1960: 148;
not listed by Suter 1913: 186 nor Powell
1979: 284, but Bergh 1900: 220, Chatham
Is record as *Archidoris* sp.
- 35 284 *Doriopsis flabellifera* (Cheeseman, 1881) *Ctenodoris flabellifera* (Cheeseman)
P2 (0)
- 35 285 *Rostanga muscula* (Abraham, 1877) *Rostanga rubicunda* (Cheeseman, 1881)
P2 (0)
- 36 285 *Chromodoris aureomarginata* (Cheeseman, 1881) *Glossodoris aureomarginata*
field identification, Dell 1960: 148, but
not listed by Powell 1979: 285
- 36 289 *Fiona pinnata* (Eschscholtz, 1831)
recorded by Suter 1913: 587 from Bergh
1900: 147, but not in Powell 1979: 289
- see Willan 1980: 142
- 37 294 *Onchidella nigricans* (Quoy & Gaimard, 1832)
W50 (March 1996) P2 (0)
- 37 291 *Gadinea conica* Angus, 1867 *Gadinea nivea* Hutton, 1878
widespread C9 C11 C16 C26 C39 P2 (0)
- 37 292 *Siphonaria australis* (Quoy & Gaimard, 1832)
widespread C9 C16 C22 C26 C39 C49 P15 (0)
[*S. zelandica* Q. & G., 1833, despite its
name is found only in Australia, hence
Dell 1960 localities apply to *S. australis*]
- 37 [292] *S. propria* Jenkins, 1983
W9 W10 W26 W27 W28 *S. cookiana* Suter, 1909
C16 C49 P15 (0)
- 37 294 *Marinula filholi* Hutton, 1878 *M. chathamensis* Finlay, 1928
widespread C9 C49 P1 (0)
- 37 295 *Leuconopsis obsoleta* (Hutton, 1878)
C9 C11 C16 P2 (0)

SCAPHOPODA

- 42 354 *Antalis suteri* (Emerson, 1954) *Dentalium* (A.) *suteri* Emerson, 1954
C15 C28 C29 C30 C31 C38 (22-94)
[see Dell 1957a: 566 for both species]
- 43 †424 *Fissidentalium zelandicum* (Sowerby, 1860)
[354] W30 C28 C29 C30 (50-94)

BIVALVIA

- 43 363 *Solemya parkinsoni* E.A. Smith, 1874 *S. (Zesolemya) parkinsoni*
W27 C28 C29 C46 (3-94)
- 43 355 *Lamellinucula dunedinensis* (Finlay, 1928) *Nucula dunedinensis* Finlay, 1928
P1 (0)
- 43 †312 *Nucula hartvigiana* Pfeiffer, 1864
[356] W12 C49 P1 (0)
- 43 356 *N. nitidula* A. Adams, 1856
C23 C24 C28 C31 C38 (0-50)
- 43 *356 *N. rossiana* Finlay, 1930
W12 (22-94)

- 43 359 *Saccella bellula* (A. Adams, 1856) *Nuculana (Saccella) bellula*
C28 C29 C31 C38
- 44 362 *Neilo australis* (Quoy & Gaimard, 1835)
W30 W31 [also Marshall, 1978: 426,
NZ Oceanographic Inst. Stn D880, 78m]
- 44 365 *Acar sandersonae* Powell, 1933
W6 W26 C23 C38 (0-43)
- 44 364 *A. sociella* (Brookes, 1926)
W6 W26 C9 (0)
- 44 364 *Barbatia novaezealandiae* (E.A. Smith, 1915) *B. novaezealandiae* (E.A. Smith)
W6 W23 W24 widespread
- 44 366 *Glycymeris modesta* (Angas, 1879)
W17 W50 P5 (0)
- 44 †394 *Tucetona laticostata* (Q. & G., 1835) *Glycymeris (Grandaxinea) laticostata*
[365] W6 W33 W39 C11 C20 C23 C24 P6 (0-38)
- 44 370 *Cosa costata* (Bernard, 1896)
W12 W39 P1 (0)
- 44 370 *C. filholi* (Bernard, 1897)
W12 C23 P5 (0-33)
- 44 369 *Lissarca harrisonae* (Powell, 1927)
W12 *Austrosarepta harrisonae*
C16 C49 P5 (0-10)
- 44 367 *Philobrya meleagrina* (Bernard, 1896) *Hochstetteria meleagrina* Bernard
C23 C24 (33-38)
- 44 367 *P. modiolus* Suter, 1913 *Hochstetteria modiolus* (Suter, 1913)
W12 C16 (0)
- 44 *367 *P. pinctada* (Finlay, 1930)
W12
- 44 371 *Verticipronus mytilus* Hedley, 1904
C16 (0)
- 44 †157 *Aulacomya ater maoriana* (Iredale, 1915) *Aulacomya maoriana*
[372] widespread widespread (0-43)
- 44 372 *Mytilus edulis galloprovincialis* Lamarck, 1819 *Mytilus aoteanus* Powell, 1958
W34 C11 C38 D5 P6 (0-43)
- 44 *372 *Perna canaliculus* (Gmelin, 1791)
W1; W33 (*fidel* local fisherman)
- 44 374 *Modiolarca impacta* (Hermann, 1872) *Musculus impactus*
widespread C14 C18 C31 P4 (15-22)
- 44 †395 *Trichomusculus barbatus* (Reeve, 1858)
[373] W12 W21 W26 C9 C16 C18 C24 C28 P1 (0-50)
- 44 *374 *Dacrydium pelseneeri* Hedley, 1906
W26
- 45 373 *Modiolus areolatus* Gould, 1850 *Volsella areolatus*
widespread C14 C18 C23 C31 P4 (15-33)
- 45 373 *Xenostrobus securis* (Lamarck, 1819) *Volsella fluviatilis* (Hutton, 1878)
D5 P13 (0)
- 45 †395 *Atrina pectinata zelandica* (Gray, 1835)
*[375] W6 W17 W40 (alive, 34-35 fathoms)
- 45 376 *Crassostrea gigas* (Thunberg, 1793)
- still no sign of its arrival by March 1996
- 45 376 *Saxostrea cucullata* (Born, 1778) *Saxostrea glomerata* (Gould, 1850)
C49 (0) only from Port Hutt, ? introduced

- 45 375 *Tiostrea lutaria* (Hutton, 1873) *Ostrea sinuata sinuata* Lamark, 1819
W1 W6 W30 W40 C26 P6 (0)
O. sinuata charlottae Finlay, 1928
C23 C24 (33-38)
- 45 378 *Chlamys gemmulata* (Reeve, 1853) *C. gemmulata radiata* Hutton, 1873
widespread C14 C23 C24 C31 D1 P6 (0-70)
- 45 †338 *C. zelandiae* (Gray, 1843) *C. suprasilis* Finlay, 1928
[379] W16 W17 W30 D1 P6 (0)
C. zeelandona (Hertlein, 1931)
C23 (33)
- 45 †160 *C. zelandiae* (forma) *dieffenbachii* (Reeve, 1853) *C. celator* Finlay, 1928
†338 widespread C14 C23 C24 D1 P6 (0-70)
[378]
- 45 377 *Mesopeplum convexum* (Q. & G., 1835) *Pallium (Mesopeplum) convexum*
W6 W17 W30 W31 W40 C15 C24 D1 P11 (30-38)
- 45 †160 *Pecten novaezelandiae* (forma) *rakiura* *P. novaezelandiae rakiura* Fleming, 1951
[377] W6 W30 W31 W40 C20 P6 (0-20)
- 45 378 *Zygochlamys dichroa* (Suter, 1909) *Chlamys dichroa*
W30 W32 D1 P11 (0)
- 45 †395 *Cyclopecten transenna* (Suter, 1913) -
[380] W26 C16 (0)
- 45 †396 *Pododesmus zelandicus* (Gray, 1843) *Monia zelandica*
[383] W1 W3 W6 W39 C18 P12 (0-15)
- 45 382 *Escalina regularis* Powell, 1955 -
C29 (94)
- 45 †180 *Lima zelandica* Sowerby, 1876 -
[381] W12 W42 (live) C23 (33)
- 45 382 *Limatula maoria* Finlay, 1926 -
W6 W31 W33 C23 (33)
- 46 385 *Lucinoma galathea* Marwick, 1953 *L. galathea*
C29 (94)
- 46 †342 *Divaricella huttoniana* (Vanatta, 1901) -
386 W6 W21 C15 C20 C28-C31 C38 P6 (0-94)
- 46 387 *Genaxinus cookianus* Fleming, 1950 -
C28 C29 C31 (22-94)
- 46 386 *Thyasira peregrina* (Iredale, 1930) *T. peroniana peregrina* (Iredale)
C29 C31 (22-94)
- 46 388 *Diplodonta (Zemysina) globus* (Finlay, 1926) *Zemysina globus* Finlay
C15 C24 C28 C38 (30-50)
- 46 388 *D. (Z.) striatula* (Finlay, 1926) *Z. striatula* Finlay
W3 W12 W27 C14 C18 C23 C36 C38 P1 (0-43)
- 46 388 *Felaniella (Zemysia) rakiura* (Powell, 1939) *Zemysia rakiura* Powell
C20 C23 C24 (20-38)
- 46 388 *F. (Z.) zelandica* (Gray, 1835) *Z. zelandica* (Gray)
W6 W9 W27 W38 C14-C16 C20 C22-C24 C31 C32 C38 (0-43)
- 46 389 *Lasaea hinemoa* Finlay, 1928 -
C11 C16 C49 P6 (0)
L. rossiana verata Finlay, 1928
C16 C49 (0)
- 46 391 *Arthritica bifurca* (Webster, 1908) -
W12 P5 (0)

- 46 390 *Borniola decapitata* (Powell, 1939)
W10
Rocheformula decapitata Powell
C16; Waitangi *sic* Powell 1979: 390. Not
in his checklist 1933: 183 since not named
until 1939.
- 46 391 *B. reniformis* (Suter, 1908)
W10 W36
Rocheformula reniformis Suter
widespread (0-43)
- 46 389 *Melliteryx parva* (Deshayes, 1856)
W12
C13 C16 C23 C24 C38 C49 P1 (0-43)
- 46 393E *Myllitella vivens pinguis* Marwick, 1928
W1 W9 W26 W27
C11 [in Dell 1960: 144 as C12] C13 C15
C16 C28 C31 C32 C46 P1 (0-5)
- 46 †436 *Kellia cycladiformis* (Deshayes, 1834)
[393]
Marikellia rotundata (Deshayes, 1855)
C14 C16 C23 C24 P1 (0-38)
- 47 397E *Mysella morioria* Dell, 1952
W39
C16 C24 C28 (0-50)
- 47 397 *M. unidentata* (Odhner, 1924)
C13 C16 C49 P1 (0-6)
- 47 †397 *Cyamiomactra problematica* Bernard, 1897
[399] W39
C13 C20 C23 C31 C32 P5 (4-33)
- 47 400 *Kidderia rakiura* Powell, 1939
C13 C16 (0-4)
- 47 400 *Kidderia (C.) costata* Odhner, 1924
W6 W12 W26
Costokidderia costata Odhner
C13 P1 (0-5)
- 47 401E *Perrierina insulana* Powell, 1933
W39
C13 C24 P5 (0-38)
- 47 402 *P. subquadrangula* Dell, 1952
C16 C23 (0-33)
- 47 403 *P. (Legrandina) turneri* (Powell, 1939)
C20 (20)
Legrandina turneri Powell
- 47 403 *Neolepton antipodum* (Filhol, 1880)
W12 W39
Notolepton antipodum (Filhol)
C16 C20 C23 C24 P5 (0-38)
Notolepton sanguineum (Hutton, 1883)
C13 C16 C20 C38 C49 P5 (0-43)
- 47 404 *Pachykellia concentrica* Powell, 1927
C16 P5 (0-10)
- 47 406 *Cardita aoteana* Finlay, 1926
very widespread
very widespread (0-94)
- 47 407 *Pleuromeris marshalli* (Marwick, 1924)
W39
C20 C23 C24 C28 C31 P5 (20-94)
- 47 †281 *Venericardia (Purpurocardia) purpurata*
[407] W3 W6 W17 W21 W30
Venericardia purpurata (Deshayes, 1854)
C15 C20 C23 C24 C28 C29 D1 P6
(20-94)
- 47 409E *Benthocardiella obliquata chathamensis* Powell, 1933
C16 P1 (0)
- 47 408 *Condylocardia crassicosta* Bernard, 1897
C16 C49 P1 (0)
- 47 408E *C. pectinata chathamensis* Powell, 1933
W26
C16 C49 P1 (0)
- 47 408 *Condyllocuna concentrica* (Bernard, 1897)
W12
Condylocardia concentrica Berenard
C16 C49 P1 (0)
- 47 409E *C. torquata* (Marwick, 1928)
Condylocardia torquata Marwick
C16 P5 (0-10)

48	413	<i>Pratulum pulchellum</i> (Gray, 1843) W30	<i>Nemocardium (Pratulum) pulchellum</i> C15 C24 C28-C31 C38 (22-94).
48	†399*	<i>Cyclomactra ovata</i> (Gray, 1843) [413] W6 W8	-
48	413	<i>C. tristis</i> (Reeve, 1854)	-
48	†399	<i>Oxyperas (P.) elongata</i> (Q. & G., 1835)	<i>Longimactra elongata</i>
48	414	<i>Scalpomactra scalpellum</i> (Reeve, 1854) W30	C13 C15 C20 C28 C29 C31 C38 P5 (4-94)
48	415	<i>Paphies australis</i> (Gmelin, 1791) W6 W34 W35	<i>Amphidesma (Paphies) australe</i> (Gmelin) P6 (0)
-	416E	<i>P. porrecta</i> (Marwick, 1928) Nukumaruan fossil, Moutapu Point, 20 feet above sea level	-
48	416	<i>P. subtriangulata</i> (Wood, 1828) W1 W6 W8 W17, and Maunganui	<i>Amphidesma (Taria) subtriangulatum</i> (Wood, 1828) C13 C20 C31 P12 (0-22); includes the living species given by Powell 1979: 416 as <i>Paphies (Mesodesma)</i> <i>subtriangulata porrecta</i> (Marwick, 1928)
48	419	<i>Elliptotellina urinatoria</i> (Suter, 1913) - [see Willan 1993: 91]	<i>Ascitellina urinatoria</i> C15 C20 C23 C24 C28 P5 (10-50)
48	417	<i>Macomona liliana</i> (Iredale, 1915) W6 W17 W35 (lagoon ones depauperate)	D1 P4 (0)
48	†399	<i>Moerella huttoni</i> (E.A. Smith, 1885) [417] -	<i>Tellinella huttoni</i> C31 (22)
48	†399	<i>Pseudarcopagia disculus</i> (Deshayes, 1855) [418] W3 W6 W24	<i>Zearcopagia disculus</i> (Deshayes) C11 C14 C16 C26 P15 (0-15)
48	†399	<i>Serratina charlottae</i> (E.A. Smith, 1885) [417] -	<i>Tellinella charlottae</i> C28 C29 C30 (50-94)
48	418	<i>Gari (Gobraeus) stangeri</i> (Gray, 1843) W6 W9 W27 [Willan 1993: 51]	<i>Gari stangeri</i> C11 C20 P6 (0-20)
48	418	<i>G. (Psammobia) convexa</i> (Reeve, 1857) W6 (= <i>G. hodger</i> Willan, 1980)	<i>G. lineolata</i> (Gray, 1835) C11 C15 C31 D1 P6 (0-30)
48	†399	<i>Soletellina nitida</i> (Gray, 1843) 418 W1 W9	- recorded only by A. Haylock in 1903 <i>lode</i> Suter 1913: 1005; and Dell 1960: 144 <i>S. cf. siliqua</i> Reeve, 1857 P6 (0)
48	†399	<i>S. cf. siliqua</i> Willan, 1993 [418] W1 [= <i>siliqua</i> of authors not of Reeve]	-
48	*420	<i>Leptomya retiaria</i> (Hutton, 1885) W3 (1 pair, 26 Jan. 1994)	-
49	420	<i>Gaimardia forsteriana forsteriana</i> Finlay, 1926	C13 C16 C22 P8 (0-4)
49	*427	<i>Dosina zelandica</i> Gray, 1835 W6	-
49	†400	<i>Austrovenus stutchburyi</i> (Wood, 1828) [426] W6 W34 W35	<i>Chione (Austrovenus) stutchburyi</i> C11 C24 C33 D5 P13 (0-38)
49	425	<i>Protothaca crassicosta</i> (Deshayes, 1835) W6	P6 (0)
49	424	<i>Tawera marionae</i> Finlay, 1928	- F1

- 49 424 *Tawera spissa* (Deshayes, 1835)
W6 C15 C23 C24 C29 C31 C38 P7 (22-94)
- 49 †401 *Irus* (*Notirus*) *reflexus* (Gray, 1843) *Notirus reflexus*
[425] W6 W7 W9 W27 C14 C18 C26 C31 C43 D1 D3 P4 (0-22)
- 49 †401 *Ruditapes largillierti* (Philippi, 1849) *Paphirus largillierti* Philippi
[426] W6 W9; W10 (1997) C11 C49 D3 P6 (0)
- 49 †401 *Corbula* (*Caryocorbula*) *zelandica* Q. & G., 1835 *Notocorbula* (*A.*) *zelandica*
[428] - C23 C24 C28 P6 (0-50)
- 49 428 *Hiatella arctica* (Linnaeus, 1767) *H. australis* (Lamarck, 1818)
widespread C14 C18 C28 C29 C43 P4 (0-94)
- 49 429 *Panopea smithae* Powell, 1950
W6 W8 W30 (live) C24 Owenga *fide* Powell; as *P. zelandica*
in his 1933 Chathams list
- 49 †401 *Barnea* (*A.*) *similis* (Gray, 1835) *Anchomasa similis*
[429] W1 W6 W8 C43 P4 (0-4)
- 50 429 *Pholadidea tridens* (Gray, 1843)
W3 W8 C43 (4)
- 50 430 *Bankia neztalia* Turner & McKoy, 1979
-
(= *brevis* of authors not Deshayes) A C F M An *fide* Powell 1979: 430
- 50 433 *Periploma* (*O.*) *angasi* Crosse & Fischer, 1864 *Offadesma angasi*
P7 (0)
- 50 †401 *Hunkydora australica novozelandica* (Reeve, 1859) *Thracia vitrea* (Hutton, 1873)
[433] - C23 C28 C38 (33-50)
- 50 432 *Myadora antipodum* E.A. Smith, 1880
- C29 (94)
- 50 433 *M. subrostrata* E.A. Smith, 1880
- C15 C20 C23 C24 C28 C29 C38 (20-94)
- 50 431 *Cleidothaerus albidus* (Lamarck, 1819) *C. maorianus* Finlay, 1927
W6 W28 D3 P6 (0)
- 50 435 *Halirus setosa* (Hedley, 1907)
- C24 C28 C29 (38-94)

CEPHALOPODA

- 50 439 *Spirula spirula* (Linnaeus, 1758)
W27 P4 (0)
- 51 441 *Sepioloidea pacifica* (Kirk, 1882)
- C25
- 52 441 *Nototodarus sloanii* (Gray, 1849) *N. sloanei sloanei* (Gray, 1849)
- [*fide* Spencer & Willan, 1996 - C F M An]
- 53 444 *Octopus maorum* Hutton, 1880
- C16 P4 (0)
- 53 444 *Octopus campbelli* (E.A. Smith, 1902) *Robsonella australis* (Hoyle, 1885)
- (= *australis* of authors not Hoyle, in part) C23 (33)
- 53 - *O. warringa* Stranks, 1990 *Robsonella australis* (Hoyle, 1885)
- (= *australis* of authors not Hoyle, in part) C23 (33)
- 53 444 *Argonauta argo* (Linnaeus, 1758)
- F1
- 53 445 *A. nodosa* Solander, 1785
- C49 P15

[Waitangi, usually arrive about May according to local people, and now illustrated on Chatham Islands T-shirts as a local treasure!]

THE MOA POINT AREA - AFTER THE SEWERS

By Jenny Raven

Midway through 1998 the main Wellington city sewer outfall near Moa Point was closed down, replaced, finally, after many years of public debate, by a new treatment plant and long outfall pipe into Cook Strait. The sewer had been there since last century, daily discharging raw sewage into sea within a few metres of the shore. A century ago the area would have been quite isolated but for the past 50 years Wellingtonians had been very aware that it was right on their doorstep.

Prior to the closure the Wellington Shell Club held a couple of field trips to the area - or at least as close as we dared - namely the adjoining peninsula on the aiuport side and surrounding bays. A few months ago we were told the water was now clean. I decided to go back to see the difference. Venturing out on the peninsula my first impression was there was a considerable lot more wash-up material. Amongst these in the low tide gravel on the right hand side, I was delighted to find a *Trivia merces*, my first ever in Wellington. Further on an *Alcithoe fusus* was lying on the surface; also a large piece of *Cabestana spengleri*. This was a good omen indeed.

At the tip of the peninsula where we searched last year I noted several small *Buccinulum vittatum* under stones. There were far fewer noted a year ago. On the side of the peninsula nearest the old sewers the shell life did not die out as we had previously noted. Rock shells (*Dicathais orbita*) were looking quite comfortable in the ledges and *Cominella maculosa* were moving about in the pools. Particularly noticeable were large adult pauas quite close in, in the low tide pools. We had not noticed them previously and although the peninsula has always been very gravelly there were now small patches of sand here and there and more interesting, quite a lot of shell sand washing in at the low tide water line.

Closer to the sewer the rocks were still covered in a gungy weed. The large *Cellana* and *Melagraplia* were still there covered in a furry growth but there were several fresh clean looking ones in amongst them. Will they now not grow so large? At the sewer itself the water was clean but the rocks were still weed saturated and very slippery. A return trip with gloves would be probably be needed in order to examine the shell life present better.

The area from the old sewer to Tarakena Bay now looked quite inviting. Away from the weed growth areas small coves were revealed. Tarakena Bay is sandy and sheltered and with the water so clean this area looked good for snorkelling.

More time is obviously needed before one can come to any conclusion about the changes. It could be argued that the wash-ups were the result of the strong winter northerlies or that the construction of the new long outfall pipe had thrown up much loose material. Perhaps the shell life has always been there and the clearer water allowed us to see more? Indications, however, from this fleeting visit looked very promising. The closure of the sewer has opened the area up considerably and I am sure that shell enthusiasts will find much to interest them here in the future.

-oOo-

WELLINGTON HARBOUR'S PAST REVEALED

By Jenny Raven

Have you driven through Kilbirnie in Wellington's eastern suburbs recently? An interesting shell sight has been revealed ...

Between Onepu Road and Mahora Street, on the airport side of the shopping centre, a large construction site has been cleared of houses and other buildings to make way for a new supermarket. While the site remains empty it is white with thousands of cockle shells, *Austrovenus stutchburyi*. This is interesting because the site, lying partway between Evans Bay and Lyall Bay, is now some distance from the sea. It leaves one wondering how old these shells are, and when they were last on a shore. Similarly, I once noticed several *Dosinia anus* and *Paphies subtriangulata* shells eroding out of a bank away up on the Strathmore ridge. All these species are shallow, sandy/silty water dwellers and are not commonly found living in either Evans Bay or Lyall Bay today. Wellington airport has intruded into both of these bays and, with reclamation and road extensions at Evans Bay, the land and sea now abruptly meet at a sea wall.

Most older Wellingtonians would be aware that in the past the Miramar Peninsula was cut off as an island from the rest of Wellington by the sea through the area that is now Lyall Bay to Evans Bay. Old maps show that pre-1460 A.D. this was indeed the case, and that several Maori pas were sited in the area over the centuries. Successive earthquakes gradually raised the land, and, following the last, very large, 1855 Wellington earthquake, the peninsula (then called Whataitai) was linked by swamps and sand. European settlement occurred rapidly from the latter half of last century and reclamation followed.

Our old house at Lyall Bay was built about 1910, one street back from the beach. If you lifted the floor boards, beautiful soft sand could be seen underneath. An aunt can remember a second small sandy beach in the area that is now the southern end of the airport and, in the 1920s, swimming out to sandbank in the middle of Lyall Bay. Old photographs taken in the early 1900s show people paddling in the area that is now part of Kilbirnie Park.

No doubt *Dosinia*, *Austrovenus*, and *Paphies* were plentiful in the shallows that used to exist between the two bays. The shells on the ridge tops were, on the other hand, more likely to have midden debris, remnants of meals once enjoyed in pre-European times. These *Austrovenus* shells may well have scrunched under the feet of the first European arrivals. We are fortunate that nature is, for the moment, allowing us a glimpse of the once plentiful existence of these shells.



Miramar Island (Motu-kairangi)
in Maori times before Hāo-wheua
(based on Stevens, 1978: fig. 13.32)



Miramar after the 1460 uplift
(Whataitai/Miramar Peninsula)
and the Kilbirnie isthmus.
(based on Stevens, 1978: fig. 13.32)

THE KILBIRNIE SHELL BED: A SLICE INTO HISTORY

By Elliot Dawson

When I read Jenny Raven's note on the Kilbirnie shell exposure, I got quite excited as I had always been intrigued by the story of Miramar Peninsula as a former island (as well as the legend of a creature named Whataitai, a local taniwha that tried to escape from the harbour by attempting to breach the narrow passage between Evans Bay and Lyall Bay, and failing to do then assumed the form of a bird and settled on the top of what is now called Mt Victoria where its wailings can still be heard at times and are taken by unbelievers to be merely the shriek of the wind - but that's all part of another story!) I also was interested because I recalled some investigations that had been done at Kilbirnie by two former colleagues at the New Zealand Oceanographic Institute (now part of NIWA Ltd) and I wondered if this new major excavation might give an opportunity of revealing further information on a grander scale than had been done by their narrow drill holes.

By the time I visited the Kilbirnie site (and what a "sight" it was!), those dreadful rains and winds of October had made life pretty intolerable for the contractors on the job. A great deep pit (well over four metres down) was filling up with water but being further extended all the same by bulldozers slicing in and dumping sand, gravel, mud and shells in big heaps. I certainly saw masses of *Austrovenus*, and *Ruditapes*, *Maoricolpus* and other ecological associates. I couldn't, unfortunately, get on to the main area of excavation so had to content myself with poking about the fence line. Once the weather had begun to clear and I got another look at the diggings, the contractors were very busy catching up on lost time, and a series of beautifully-stratified shell beds exposed at about two metres depth on the south (Lyall Bay) side of the site were being quickly covered up before my very eyes with concrete and steel. Now, to my great regret, the chance of further scientific investigation here has gone, and a new shopping complex will soon mask this slice into our early local history - such a pity, but that's progress. Even more feet will scrunch over those old buried shells ...

Graeme Stevens (1978: 246-248, fig. 13.32) in *Rugged Landscape*, his popular account of the geology of central New Zealand, has given an overall account of how Miramar lost its island status (based on the historical accounts of Crawford, Best, Cotton, and Adkin) - and gives some good photographs of to-day's scene (figs 5.1, 5.2, 5.56, 9.7, 13.33) which are helpful for those who are not Wellingtonians. But the underlying story (no pun intended) has since been revealed by the work of Keith Lewis and Lionel Carter (in conjunction with some other colleagues at the former New Zealand Geological Survey) who were called in to report on the possible effects of extending the runway of the Wellington airport into Evans Bay and what the geological structure was on which it would be based.

Anna Rogers (1996), in her compilation of New Zealand tragedies as demonstrated by earthquakes, has an eloquent passage which is worth quoting to put the local events into the wider time frame -

"About 1460, when the Wars of the Roses were five years old and nine years before Lorenzo the Magnificent became ruler of Florence, an extraordinary and equally cataclysmic event was occurring thousands of miles south of Renaissance Europe. A mighty earthquake, known to the Maori as Hao-whenua - the land swallower or destroyer - lifted from beneath the sea the piece of Wellington land now known as the Miramar Peninsula. In the early days of this century Elsdon Best was told by Wairarapa Maori that this earthquake occurred in the time of Te Ao-haere-tahi, who lived "some eighteen generations ago." ... "

(Rogers, 1996: 70)

That would have been a quake to remember! George Eiby (1989) has suggested it might have been a force 8 quake, about the same as the famous 1855 Wellington quake which was felt by the new European settlers as well as the descendants of the tangata whenua who had experienced

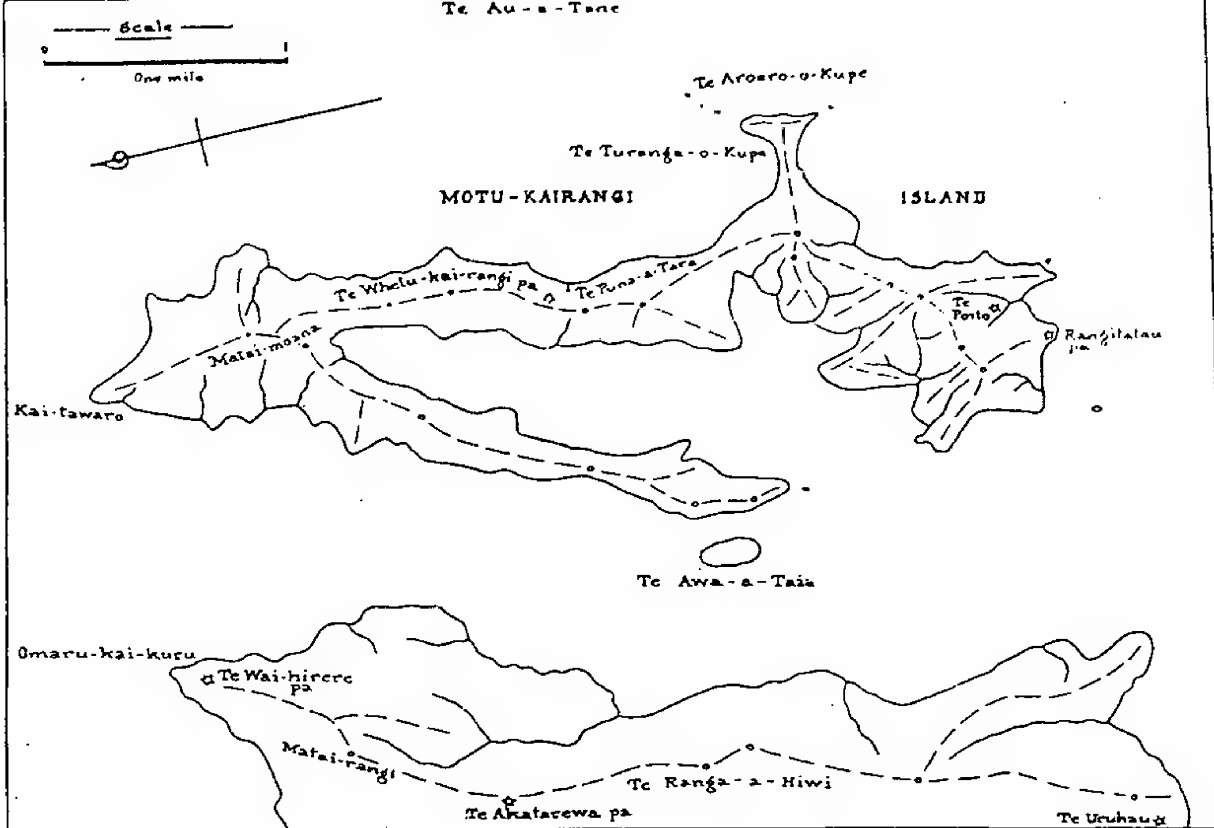
Later, by making side-scan sonographs of the sea floor and mapping the strata underlying it by high-resolution seismic profiling at 25 metres interval across the southern part of Evans Bay, as well as drilling 3 cores, one on reclaimed land and inside Evans Bay, a picture was built up of the underlying structure of Evans Bay close to the adjoining isthmus (Lewis *et al.*, 1985). The layers of sediment below the seafloor, going down to the greywacke rock basement of the former channel, were shown to consist of four distinct seismic sequences - A. 3 to 4 m in depth, being sediments deposited in a low energy, sheltered environment, much like present day conditions, since the sea reached its present level (about 6,500 years ago); B. 3 to 5 metres in depth, sediments indicative of a relatively high level, presumably shallow, marine environment, deposited during the postglacial rise of sea level; C. 6 to 12 metres, valley deposits laid down during the last glacial age; and D. sediments possibly laid down during the last interglacial phase. The cores showed that these layers were thicker on the land than offshore in Evans Bay.

The later analysis of borehole sediments (from the 3 cores, one on reclaimed land and two offshore) by Lewis *et al.* (1985) confirm the seismic profiler evidence and provide the detail for the generalised story by Lewis & Carter (1976) - the topmost, surface layer is shelly sand, overlain in places by later reclamation fill, then laminated sandy silts, followed by a pieces of wood (possibly *in situ* tree roots) in a sharply alternating series of carbonaceous sands, silts, muds, and gravels, with peat at its base. Beneath this is a layer of shelly sands up to 15 m thick. It contains a few silt layers and some conspicuous shell layers. Radiocarbon dates were also obtained - for example, a sample of wood from 8.7 m down one of the sea cores gave a date of 9210 +/- 770 years before the present. The shells are described by Lewis *et al.* as "comprising a calm-water, shallow, nearshore marine fauna including *Maoricolpus roseus*, *Venerupis* cf. *largillierti*, *Xymene*, *Dosinia*, ? *Mactra* (? *Cyclomactra*), and *Soletellina*, with the addition of some brackish-water species, *Austrovenus* cf. *stutchburyi* and *Melanopsis trifasciata* (P.A. Maxwell pers. comm.)." The basal layer is a gravelly sand mud with rare carbonaceous layers, lying over a weathered greywacke basement found in the land bore at 40 m below the sea bed. The revised geological history of the Evans Bay side of the former channel shows that prior to the 3 metre earthquake uplift in the 15th century, there was a drowned river valley (probably eroded along the shatter zone of a late Pliocene fault on the eastern side of the bay) partly infilled with sediments during two glacial/interglacial cycles. The infilling sediments included two assemblages - (1) interglacial age shelly marine sands and muds which have a pollen flora from flourishing rimu/podocarp forests, and (2) glacial age gravelly and carbonaceous terrestrial deposits which have a pollen flora dominated by grasses or, in slightly milder conditions, by beech and manuka.

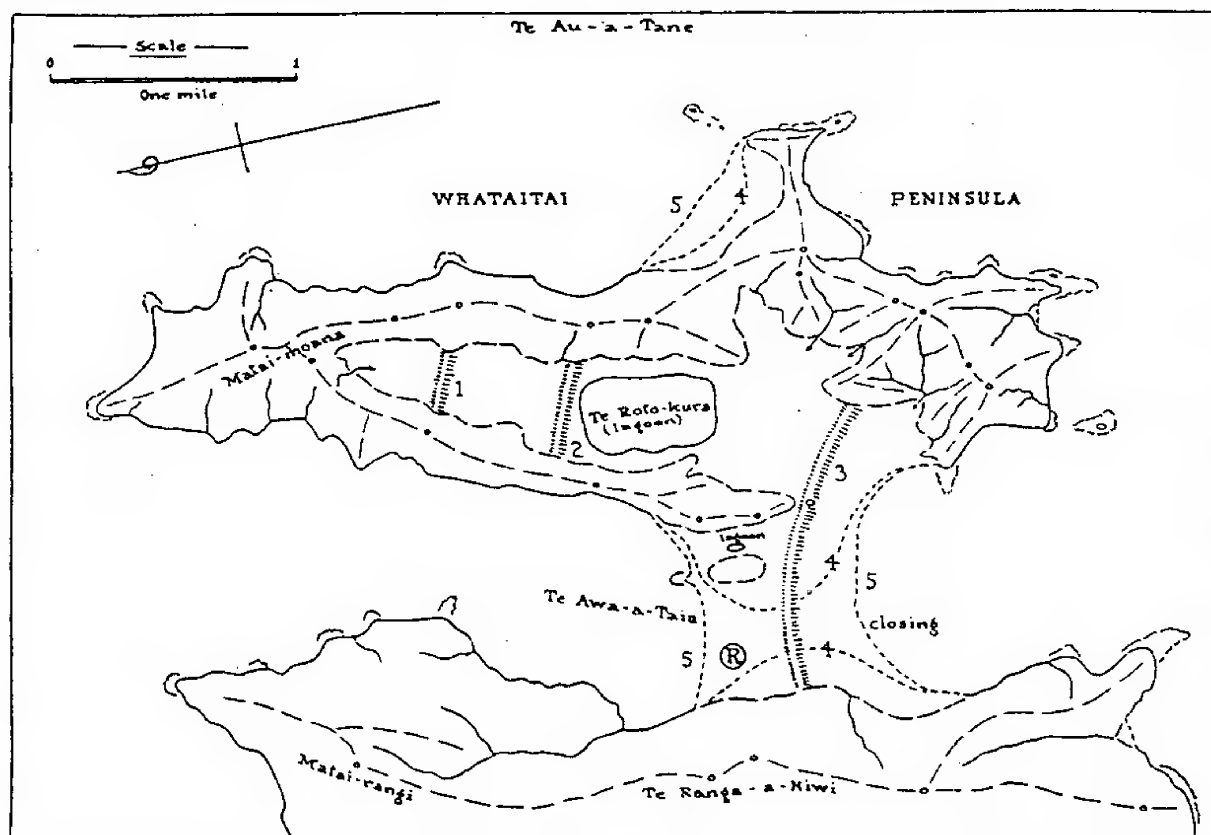
So far as where Jenny Raven's shell exposure fits into the scheme of things ...

The topmost sediments dug into by today's Kilbirnie excavators represent a part of "sequence A" of Lewis *et al.*, a "steady graduation" from shelly sand, overlain by reclamation fill, to shelly sand mud and shelly mud as shown in their two offshore cores. The 4 or more metres exposed in the current site excavations in Kilbirnie have probably only penetrated into this A sequence although I noted muddier-looking material coming out of the deepest dig - this could be part of next sequence B but it is more likely that disruption of sedimentation in the last 6,500 years has made detailed interpretation of events within sequence A rather difficult. The depth and extent of the various lenses of sediment can be complicated as to how they relate to the topography of the original channel or embayments in which they were laid down. Really all we can say about the date of Jenny Raven's shells are that they are relics of what was alive in the channel between Miramar and to-day's Hataitaitai before the uplift of 1460. Adkin's Map III (1959: 118) shows the site of the former channel, Te Awa-a-Taia, which went through what is now the middle of the Kilbirnie business area. Jenny Raven's site is close to the western edge of this channel and only metres from the two gravel beach ridges which are suggestively of a 1460 vintage.

Truly, as Jenny Raven wrote, "We are fortunate that nature is, for the moment, allowing us a glimpse of the once plentiful existence of these shells" and the story of which they are a part.



Motu-kairangi, the geographical predecessor of Whataitai or Miramar Peninsula according to Adkin (1959: 18, fig. 1).



Stages in the evolution of Miramar Peninsula (the Whataitai of the old-time Maori) within the period of human occupation (i.e. from about the 13th century) showing the effect of earthquake uplift and island tying (according to Adkin, 1959: 19, fig. 2). 1, 2, and 3, formation of successive gravel bars (beach ridges); 4, formation of sandspits (or developing "tombolos"); 5, final shore line of the Kilbirnie or Rongotai isthmus after the uplift from the Hao-whenua earthquake about 1460 but prior to the further uplift following the 1855 earthquake. Further reclamations and extensions of land have been made subsequently. This is well shown in Figure 16 of Lewis & Carter (1976). See Pickrill (1979) for details of the Lyall Bay side.

Jenny Raven's shell site on the block bounded by Rongotai Road, Onepu Road and Mahora Street is indicated by the symbol ®.

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SHELL COLLECTING ON MAJURO ATOLL, MARSHALL ISLANDS 1997

By Don Watson

[Editor's note: Don Watson's notes are of particular interest since, in contrast to the immense amount of information on the molluscs of the Northern Marshall Islands, there is still a relative lack of species lists of the marine fauna of the Southern Marshall Islands (of which Majuro is one). Indeed, a United Nations recommendation in 1988 was to get an inventory made of the marine life of Majuro. To set Don's contribution in perspective, a companion article, backgrounding the history of the Marshall Islands as it relates to the developed knowledge of their natural history, follows. I am especially grateful, as an editor, to Bruce Marshall for directing me to the basic paper by Kay & Johnson which not only gives a comprehensive checklist but also details the investigations that have been done on the molluscs of the Northern Marshalls. It has helped me greatly in arranging Don's species list.]

* * *

Pat and I were off on holiday! Our flight by Qantas took us from Wellington to Sydney. There was a two-hour wait in Sydney while we changed flight to Honolulu. We arrived at Honolulu at 11.30 p.m., went through customs and so on, and by the time we had rung the Plaza hotel for our room it was 12.30 a.m. We had to be at the airport by 7 a.m. next day to check our luggage in at Continental Air to our destination, Majuro Atoll, one of the Marshall Islands, five hour's flight time away.

About half way through the flight we had to drop off two passengers on a small island called Johnston. As we were dropping down it looked pretty shallow around the atoll. That's where they burn off the gas from the nuclear waste. At times, they say, the sky is sometimes purple around Johnston Island. When we arrived over Majuro, we could see all the green patches, and said "It can't be pine trees!" Of course it was coconut palms. Majuro has a long runway right on the edge of the reef. When we stepped off the plane on to the concrete runway, the heat hit us like an oven. "Oh, boy! It must be 40 degrees at least," I said. After sitting for hours in the air conditioning, we certainly felt this heat. Our nephew Peter was waiting for us at the airport; he was laughing his head off when he saw Pat in her long pants and jacket.

Majuro Atoll is about 35 miles long, and, in places, it's only about 50 metres wide. You can see the high tide line just off each side of the road there. The height of the atoll is only between one and two metres above sea level. You could imagine that a decent wave would wash clean over it. But since the atoll is surrounded by very deep water, the waves have nowhere to build up on. A hundred metres from the reef edge it drops off to 3000 feet. The atoll has a lagoon on one side and open water to a reef on the other. The shells that I collected on the lagoon side are noted in the following list as "lagoon side" whereas those which I got on the reef side I have labelled "south side."

It was strange not to find sea gulls in this part of the world. They were replaced here by terns. I saw a white reef heron and some sandpipers bobbing their heads up and down. I didn't snorkle on the south side because it looked too dangerous. The waves weren't big but they had a lot of power behind them. The water surged over the coral and back down again. I certainly didn't fancy getting dragged, ripped and scratched, over coral!

The next day Pat, Jebba and I went off shell collecting. We had never collected on coral reefs before nor had looked for tropical shells, so we were new chums at it. Pat was walking along the reef and saw a nice hole with blue water in it so she thought she would cool off, but to her surprise the water was just as warm as the air. We walked into a shallow part of the reef and turned over some rocks. What a surprise! There were strombs, mitras, bursas, cymatiums - I couldn't believe it. My thrill of the day was finding two nice *Harpa armouretta*. I never thought I'd find a harp shell. Jebba asked me - "Do you know how to get the hermit crabs out of their shells?" I had to say - "No, not really." She opened her mouth and faced the aperture of the shell into her mouth and blew her hot breath

shell?" I had to say - "No, not really." She opened her mouth and faced the aperture of the shell into her mouth and blew her hot breath into it, and the hermit crab crawled out ... She got a few out, so I tried - but I was not very successful! I told her she had more "blow" than me. While we were heading back home, I kept thinking that there's got to be a better way to get those hermits out. So Pat and I put some into a snap-top plastic bag and snapped it shut. Pat put it on the balcony in the sun. When the heat had built up in the bag, the crabs crawled out of their shells - boy, did that make it wasy! The contactors McConnell Dowell were just finishing off the reservoir. On each side of the airport runway there are shallow channels to catch the rainwater, which is then pumped into the reservoir. There is quite a lot of rain on Majuro but it doesn't last long because the atoll isn't very wide and the rain blows past quickly. We didn't even bother getting out of the rain when it came because an hour or two later we were dry again. How they got the material for making the reservoir was by blowing up the inner reef (which was dead anyway) and they also used this for roading.

Next day, Jebba took us down to the west end of the atoll where their new house is being built. The beaches down there are golden or white sand, very nice and good for swimming. We collected a few shells there but there were not a lot. That area is known as Laura, and the atoll is a lot wider here, with a lot of breadfruit, pandanus, and banana trees. On the way back we thought we had better buy some stores such as meat and so on. But the meat is brought in frozen and it's expensive. So we bought some bread, and it was terrible. So American bread was off the menu! We bought a cabbage, and to us that looked like ten years old! However, Jebba made a coleslaw with fruit mixed in it. Pat fell in love with coconuts - and had coconut and coconut ... We just had a cup of tea for breakfast since we didn't feel like eating. The next day Jebba took us into the town. We found that nobody registers their cars - they are just as good as the cars I had seen on the Chatham Islands, rusting, no bonnets. A lot of the houses consisted of plywood exteriors with plywood shutters propped up for windows. We did see some nice houses. Jebba asked Pat if she would like to have a go on the gambling machines. Pat said "Yes" - so we stopped outside a building. There was no sign to say what was inside, the plywood exterior as usual, but once inside it was pretty flash. Pat came out winning! The people were very friendly, and on the way back we had a couple of games of tenpin bowling. We found the new Outrigger Hotel pretty flash also, and the food was very good as we found with Jebba's family and some of the workers.

Peter finishes work about 5 p.m. There's a clubroom where he and the boys meet after work, have a few drinks, and relax after a hot day's work, and play darts and pool. We found their hospitality tremendous. About 9 a.m. on the next day, we went off collecting again on the south side of the atoll, not far past the west end of the airport. We found a little beach inside of the reef at low tide and collected a few cones, cowries, bubble shells, bivalves, and a lot of small shells. We also saw three different kinds of sea urchins, what we would call kina at home. We came across about three limpets on a rock there but I didn't have a knife with me, and I never got back to this place. I did find a limpet washed up on the beach but limpets seemed pretty few and far between. Peter had organised a trip out with an American chap who takes out Marshall Islands divers. His boat was about 12 metres in length. They dive on the outside of the reef for little tropical fish for the Japanese market. The divers take little butterfly nets down with them plus spring-loaded plastic containers to load the fish, which are all colours as well as multicoloured. When the divers surface, they have to turn some of the fish upside down and push a hollow needle into them to let out air; then they put them into plastic containers with their initials on them, keeping them in drums filled with seawater. Some particular colours are worth \$1000 each. The divers had three dives, one to 100 feet, then 80 feet and 60 feet, but their waiting times were too short. One diver lay on the deck of the boat all the way back to the wharf with a headache.

Early next morning I went snorkelling in front of Peter's flat which is about 20 yards from high tide level on the lagoon side of the atoll. It seemed unusual snorkelling without a wetsuit or a weight belt. I floated easily; it seemed very salty! I snorkelled down and turned over ... dead coral lying loosely on the sea bed, most of the shells looking pretty grotty to me, but then, amongst the live

weight belt. I floated easily; it seemed very salty! I snorkelled down and turned over ... dead coral lying loosely on the sea bed, most of the shells looking pretty grotty to me, but then, amongst the live coral - a big tiger cowrie! There were large flat pieces of dead coral, so I turned them over and collected a lovely eglantina cowrie and a few others, also an orange and white cymatium, and a dead murex, *Chicoreus bruneus*, which was a good clean one. At low tide on the lagoon side you could find *Chicoreus* on rocks once your eyes got used to seeing them since they were covered in green weed and hard to spot at first. Pollution is a real problem. On the lagoon side of the atoll it is really shocking. When Pat and I went snorkelling there we saw pieces of carpet, cans, galvanised iron, and coconut palm debris. I saw three abandoned fishing nets in a short distance of the reef in about 10 metres depth. On the beach out from the town I counted 34 empty drink tins in a square metre. They have a lot of little shops that sell chickens. When the islanders stop on the beach to eat their chickens, they just open the car window and throw the polystyrene containers out - what a mess! A chap who runs the dive shop has just finished a video of the pollution under water and is putting it to the government to get it cleaned up. I hope he succeeds!

You could certainly collect a very nice lot of shells if you were there for twelve months or so. The following list shows what we did in the short time we were there - it was an enjoyable holiday and a new experience.

Identifying the shells we got was quite difficult at the time since I didn't have books with me. But, once we were back home, John Marston was a great help. He spent many hours on the smaller species - so many thanks to him for this help.

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SHELLS COLLECTED ON MAJURO ATOLL: OCTOBER 1997

GASTROPODA

ACMAEIDAE

- Acmaea* [*Patelloida*] *saccharina* (Linnaeus, 1758) On small beach inside reef, south side of atoll

TROCHIDAE

- Tectus fenestratus* (Gmelin, 1791) On reef, live, south side of atoll
Trochus niloticus Linnaeus, 1767 Collected all round the atoll
T. radiatus (Gmelin, 1791) On reef, south side of atoll

TURBINIDAE

- Turbo setosus* Gmelin, 1791 On reef, south side of atoll

NERITIDAE

- Nerita albicilla* Linnaeus, 1758 Among stones inside reef, live, south side
N. plicata Linnaeus, 1758 On rocks, high tide, just past airport, live
N. polita Linnaeus, 1758 Among rocks inside reef, live, south side
N. textilis Gmelin, 1791 On beach, lagoon side of atoll
N. undata Linnaeus, 1758 Among stones on reef, live, lagoon side
Puperita japonica (Dunker, 1860) High tide line, lagoon side of atoll

LITTORINIDAE

- Littorina coccinea* (Gmelin, 1791) High tide line, lagoon side of atoll

RISSOIDAE

- Rissoina ambigua* (Gould, 1849) High tide line, lagoon side of atoll

PLANAXIDAE

- Planaxis sulcatus* (Born, 1780) Beach collection near reef, south side

CERITHIIDAE

- Bittium zebrum* (Kiener, 1841) Beach collection, shell drift
Cerithium articulata (Adams & Reeve, 1850) On sand, Laura Beach, west end of island
C. aspera (Linnaeus, 1758) On sand, Laura Beach, west end of island; on reef at low tide
C. columna Sowerby, 1834 On reef, low tide, with hermit crab
C. egenum Gould, 1849 High tide line, lagoon side of atoll
C. interstriatum Sowerby, 1855 High tide line, lagoon side of atoll
C. nesioticum (Pilsbry & Vannatta, 1905) High tide line, lagoon side of atoll
C. sinensis (Gmelin, 1791) High tide line, lagoon side of atoll
Clypeomorus alveolus (Hombron & Jacquinot, 1841) In shell sand, high tide line
C. batillariaeformis Habe & Kosuge, 1966 Beach collection, inside reef
C. brevis (Quoy & Gaimard, 1834) On small beach inside reef

Clypeomorus chemnitziana (Pilsbry, 1901)
C. moniliferus (Kiener, 1841)
C. nodulosum Bruguière, 1792
C. tuberculatum (Linnaeus, 1791)

Beach collection inside reef
 On reef, low tide, with hermit crab
 Given to me by small boy
 Beach collection inside reef

STROMBIDAE

Strombus gibbosus (Röding, 1798)
S. luhuanus Linnaeus, 1758

S. mutabilis Swainson, 1821

Among stones inside reef, south side
 Under stones inside reef, south side;
 also lagoon side and just before airport
 Among stones inside reef, south side

VANIKORIDAE

Vanikoro cancellata (Lamarck, 1822)

On little beach inside reef, south side;
 on beach, lagoon side

CAPULIDAE

Cheilea tortilis (Reeve, 1859)

On small beach inside reef, south side

CYPRAEIDAE

Cypraea annulus Linnaeus, 1758
C. arabica Linnaeus, 1758
C. argus Linnaeus, 1758
C. caputserpentis Linnaeus, 1758
C. carneola Linnaeus, 1758
C. depressa Gray, 1824

C. eglantina Duclos, 1833

C. helvola Linnaeus, 1758
C. hirundo Linnaeus, 1758
C. isabella Linnaeus, 1758
C. lynx Linnaeus, 1758
C. maculifera (Schilder, 1932)
C. mappa Linnaeus, 1758
C. mauritiana Linnaeus, 1758
C. moneta Linnaeus, 1758
C. poraria Linnaeus, 1758
C. scurra Gmelin, 1791
C. talpa Linnaeus, 1758
C. tigris Linnaeus, 1758

Beach collection on reef at low tide
 Beach collection, just before airport
 Beach collection, just before airport
 Beach collection on reef at low tide
 Bought in town from local people
 On reef side of atoll; beach collection on lagoon side
 Snorkel collected under flat coral plates, live, 8 ft depth, lagoon side of atoll
 In shell drift, high tide line
 On small beach, lagoon side of atoll
 On small beach, inside of reef
 Given to me by young Marshallese girl
 On reef, low tide, live, west side of atoll
 Bought in town from local people
 On reef on stones, live, west side of atoll
 Collected on reef
 On small beach inside of reef
 On small beach inside of reef
 Bought in town from local people
 Snorkel collected, in coral, 15 feet depth, live, lagoon side; also bought in town from local people

NATICIDAE

Natica gualteriana Recluz, 1844
Polinices tumidus (Swainson, 1840)

On small beach inside reef, south side
 In shell drift, high tide line, lagoon side

CASSIDIDAE

Casmaria ponderosa (Gmelin, 1791)

Beach, lagoon side near airport; also given to me by local boy

CYMATIIDAE

Charonia tritonis (Linnaeus, 1767)

Bought from local people raising money for a mammagram machine

Cymatium gemmatum (Reeve, 1844)

On small beach inside reef, west side

C. hepaticum (Linnaeus, 1758)

Snorkel collected, 6 feet, lagoon side

C. muricinum (Röding, 1798)

Beach collection, low tide, edge of reef

C. nicobaricum (Röding, 1798)

Among stones inside of reef

C. pileare (Linnaeus, 1758)

On reef, low tide, west side of atoll

C. rubeculum (Linnaeus, 1758)

Snorkel collected, 10 feet, in coral, lagoon inside of atoll

BURSIDAE

Bursa bubo (Linnaeus, 1758) [*lampas* of authors]

Given to me by a Majuro woman

B. granularis (Röding, 1798)

Under stone on reef

B. rosea (Perry, 1811)

On reef at low tide

TONNIDAE

Malea pomum (Linnaeus, 1758)

On reef

Tonna perdx (Linnaeus, 1758)

Bought from local Majuro people

TRIPHORIDAE

Mastonia rubra (Hinds, 1843)

On small beach inside reef, south side

Viriola elegans (Hinds, 1843)

On small beach inside reef, south side

MURICIDAE

Chicoreus brunneus (Link, 1807)

Snorkel collected, 10 feet, inside large coral mounds, lagoon side; on rocks, low tide, live, lagoon side

C. ramosus (Linnaeus, 1758)

Given to me by local woman

THAIDIDAE

Drupa grossularia (Röding, 1798)

On reef, low tide, live

D. morum Röding, 1798

On reef, low tide

D. ricinus (Linnaeus, 1758)

On reef, low tide

D. rubusidaeus Röding, 1798

On reef, low tide

Drupella cornus (Röding, 1798)

On reef, low tide, south side; on high tide line, lagoon side

Morula auriantica (Hombron & Jacquinot, 1853)

On reef, low tide, south side

M. granulata (Duclos, 1832)

On reef, low tide, south side

M. margariticola (Broderip, 1832)

M. uva (Röding, 1798)

On reef, low tide, south side

Nassa francolina (Bruguière, 1789)

On reef, low tide, south side

Among stones inside reef, low tide, south

<i>Thais echinata</i> (Blainville, 1832)	Beach collection, low tide, lagoon side
<i>T. tuberosa</i> (Röding, 1798)	On rocks, low tide, live, south side of atoll
BUCCINIDAE	
<i>Cantharus undosus</i> (Linnaeus, 1758)	Beach collection, high tide, lagoon side
<i>C. [Prodotia] iostoma</i> (Gray, 1834)	Beach collection, high tide, lagoon side
<i>Engina mendicaria</i> (Linnaeus, 1758)	On reef, low tide, south side of atoll
<i>Pisania truncata</i> (Hinds, 1841)	Beach collection, lagoon side of atoll
COLUMBELLIDAE	
<i>Pyrene (Columbella) testudinaria</i> (Link, 1807)	On small beach inside reef, south side
<i>P. (C.) testudinaria latescens</i> Souverbie, 1866	On small beach inside reef, south side
<i>P. (C.) turturina</i> (Lamarck, 1822)	On small beach inside reef, south side
NASSARIIDAE	
<i>Hebra horrida</i> (Dunker, 1847)	On small beach inside reef, south side
<i>Nassarius (Alectrion) papillosus</i> (Linnaeus, 1758)	Under stones inside reef, south side
<i>N. (Hima) pauperus</i> (Gould, 1850)	High tide line, lagoon side of atoll
<i>N. (Plicarularia) troendleorum</i> Cernohorsky, 1980	On small beach inside reef, south side
<i>N. (Zeuxis) margaritifer</i> (Dunker, 1847)	On reef, low tide, south side of atoll
FASCIOLARIIDAE	
<i>Peristernia nassatula</i> (Lamarck, 1822)	Under stones inside reef, south side
HARPIDAE	
<i>Harpa amouretta</i> Röding, 1798	Among stones, low tide, near reservoir. south side of atoll
MITRIDAE	
<i>Cancilla rufilirata</i> (Adams & Reeve, 1850)	Shell drift, high tide level, lagoon side
<i>Mitra acuminata</i> Swainson, 1824	On small beach inside reef, south side
<i>M. [Strigatella] assimilis</i> Pease, 1868	On small beach inside reef, south side
<i>M. avenacea</i> Reeve, 1845	High tide line, lagoon side of atoll
<i>M. cucmerina</i> Lamarck, 1811	High tide line, lagoon side of atoll
<i>M. fastigium</i> Reeve, 1845	On small beach, inside of reef, south side
<i>M. ferruginea</i> Lamarck, 1811	Among stones inside reef, south side
<i>M. imperialis</i> Röding, 1798	Among stones inside reef, south side
<i>M. [Pterygia] nucea</i> (Gmelin, 1791)	Among stones inside reef, south side
<i>M. pauperecula</i> (Linnaeus, 1758)	Under stones on reef, south side
<i>M. peregra</i> Reeve, 1844*	On small beach inside reef, south side
<i>M. pica</i> (Dillwyn, 1817)	Under stones inside reef, south side
<i>Mitra [Nebularia] tornata</i> Reeve, 1845§	On small beach inside reef, south side
<i>M. stictica</i> (Link, 1807)	On small beach inside reef, south side
<i>Pterygia dactylus</i> (Linnaeus, 1767)	Among stones, low tide, south side
<i>Scabricola eximia</i> (A. Adams, 1853)	Inside reef, south side of atoll

COSTELLARIIDAE

<i>Vexillum (Costellaria) exasperatum</i> (Gmelin, 1791)	In shell drift, high tide line, lagoon side
<i>V. (Pusia) bernhardina</i> (Röding, 1798)	In shell drift, high tide line, lagoon side
<i>V. (Pusia) crocatum</i> (Lamarck, 1811)	In shell drift, high tide line, lagoon side
<i>V. (Pusia) lautum</i> (Reeve, 1845)	Near reef, south side of atoll
<i>V. (Pusia) millecostatum</i> (Broderip, 1836)	Beach collection

TURRIDAE

<i>Turridrupa bijubata</i> (Reeve, 1843)	High tide level, lagoon side of atoll
<i>Turris (Pleurotoma)</i> sp.	Beach collection, lagoon side

CONIDAE

<i>Conus arenatus</i> Hwass in Bruguière, 1792	Among stones on reef, lagoon side of atoll
<i>C. chaldaeus</i> (Röding, 1798)	Under stones on reef, low tide, live
<i>C. coronatus</i> Gmelin, 1791	On reef, south side of atoll
<i>C. distans</i> Hwass in Bruguière, 1792	Collected high on beach
<i>C. ebraeus</i> Lamarck, 1758	On reef, low tide
<i>C. flavidus</i> Lamarck, 1810	On reef, low tide, west side of atoll
<i>C. frigidus</i> Reeve, 1848	On reef, south side of atoll
<i>C. glans</i> Hwass in Bruguière, 1792	On beach, lagoon side of atoll
<i>C. lividus</i> Hwass in Bruguière, 1792	On reef, low tide, west side of atoll
<i>C. marmoreus</i> Linnaeus, 1758	Snorkel collected, 10 feet, low tide, under dead coral plates, lagoon side of atoll; also bought from local people
<i>C. miliaris</i> Hwass in Bruguière, 1792	On reef, low tide, west side of atoll
<i>C. planorbis</i> Born, 1788	On reef, low tide, west side of atoll
<i>C. sponsalis</i> Hwass in Bruguière, 1792	On reef, south side of atoll
<i>C. virgo</i> Linnaeus, 1758 [juvenile]	On beach inside reef, low tide, south side

TEREBRIDAE

<i>Terebra crenulata</i> (Linnaeus, 1758)	On high tide line, lagoon side just before airport; on sand, Laura Beach, west end
<i>T. maculata</i> (Linnaeus, 1758)	Given to me by young local boy

PYRAMIDELLIDAE

<i>Otopleura mitralis</i> (A. Adams, 1855)	Inside reef, low tide, lagoon side
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ATYIIDAE

<i>Haminoea hydatis</i> (Linnaeus, 1758)	High tide line, lagoon side of atoll
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MELAMPIDAE

<i>Melampus castaneus</i> (Mühlfeldt, 1818)	On small beach inside reef, south side
<i>M. fasciatus</i> Deshayes, 1830‡	On small beach inside reef, south side
<i>M. luteus</i> (Quoy & Gaimard, 1832)‡	On small beach inside reef, south side

BIVALVIA

MYTILIDAE

Modiolus sp. Beach, south side of atoll (very scarce)

ISOGNOMONIDAE

Isognomon incisum (Conrad, 1837) Living on underside of stones, shallow water, south side of atoll

PECTINIDAE

Chlamys pallium (Linnaeus, 1758) On beach, lagoon side of atoll

SPONDYLIDAE

Spondylus sp. Beach collection near airport, lagoon side

CHAMIDAE

Chama lazarus Linnaeus, 1758 On reef, south side of atoll

LUCINIDAE

Codakia tigerina (Linnaeus, 1758) On reef, low tide, south side of atoll

CARDITIDAE

Cardita sp. Beach collection, lagoon side

CARDIIDAE

Fragum fragum Linnaeus, 1758 On sandy beach, Laura, west end of atoll

TELLINIDAE

Tellina palatam Iredale, 1929 On reef, low tide, west side of atoll
T. scobina Linnaeus, 1758 On reef, low tide, live, south side of atoll

PSAMMOBIIDAE

Asaphis dellorata (Linnaeus, 1758) On reef, west end of airport, west side
A. violascens (Forskål, 1775) Among rocks on lagoon side of atoll

TRIDACNIDAE

Hippopus hippopus (Linnaeus, 1758) Given to me by local small boy
Tridacna crocea Lamarck, 1819 Given to me by local small boy

GLOSSIDAE

Meiocardia tetragona (Adams & Reeve, 1848) Under stones on reef, live, south side

VENERIDAE

Gafrarium pectinatum (Linnaeus, 1758)

Among stones, south side of atoll

Periglypta edmondsoni Dall, Bartsch & Rehder, 1938†

On reef, low tide, live, south side

P. puerpera (Linnaeus, 1771)

Beach collection, low tide, lagoon side

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Editor's notes:

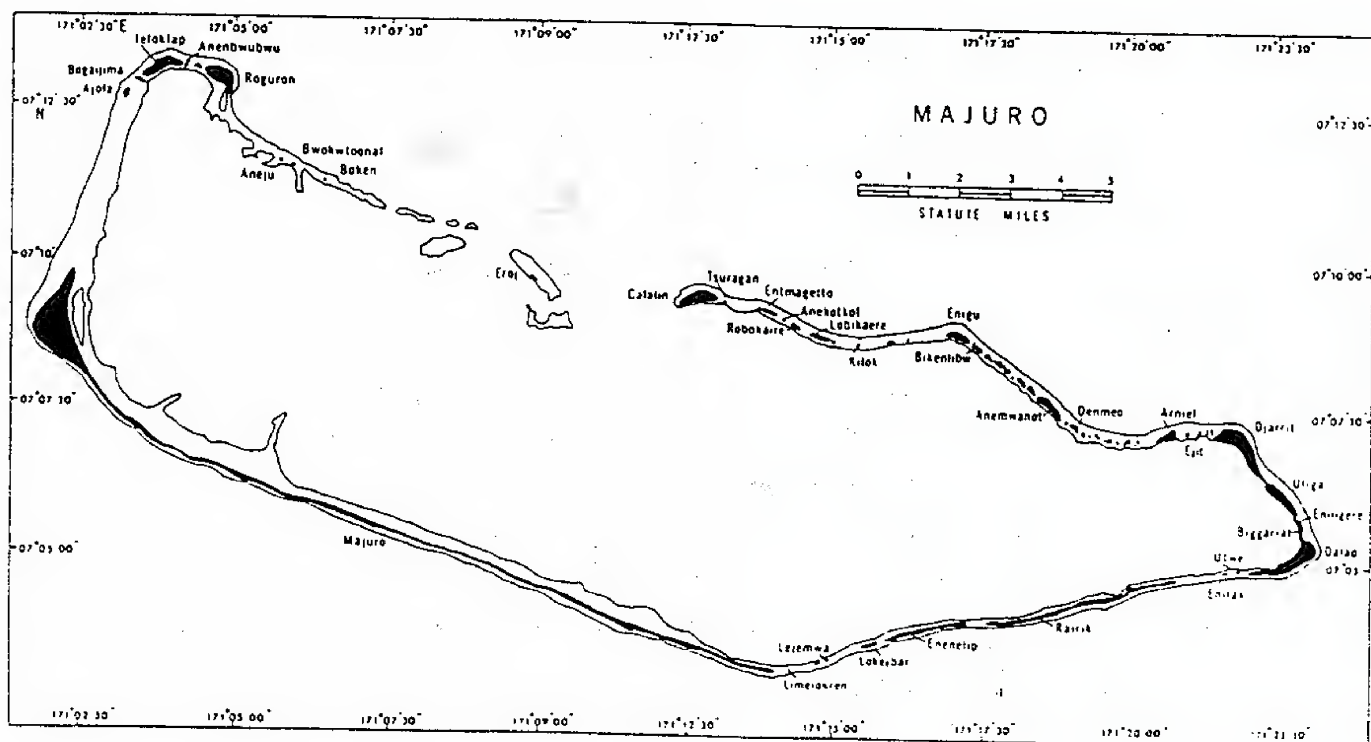
* = *M. (Nebularia) cucumerina* Lamarck, 1811 *vide* Kay, 1979: 298.

§ = *M. (Nebularia) fraga* Quoy & Gaimard, 1833 *vide* Kay, 1979: 300; but see also Crosse, E.R. 1973: Hawaiian deep water miters. *Hawaiian Shell News* XXI (6): 1, re. distinctions. Cernohorsky (1976: 405) recorded *N. fraga* from the Marshall Islands but not from Majuro.

‡ = forms of *Melampus flavus* (Gmelin, 1791) *vide* Cernohorsky, 1972: 213.

† = *P. reticulata* (Linnaeus, 1758) *vide* Kay, 1979: 569.

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A BACKGROUND TO JOHNSTON ISLAND AND THE MARSHALL ISLANDS; AND SOME FURTHER MOLLUSCAN COMMENT

By Elliot Dawson

Johnston Island which lies 1328 km southwest of Hawaii (that is, about a third of the distance between Honolulu and Majuro airports) is one of the most isolated coral reefs in the world, the nearest other reef being 800 km away in the Hawaiian Islands (Maragos & Jokiel, 1986). Although the lagoon has flourishing coral formations, all terrestrial and surrounding reef areas have been seriously disturbed by dredging or man-made structures. This atoll played a central role in the U.S. nuclear testing programme of the late 1940s to 1963. After the Vietnam war drums of Agent Orange, a chemical defoliant, were stored there. Leaking from these drums (and from earlier plutonium spills) caused considerable contamination but in 1976 the defoliant was incinerated at sea using the specially designed Dutch ship *Vulcanus*. About 10 years ago thousands of tons of chemical munitions (nerve and mustard gas) were stored on the island but a plant has been built by the U.S. Army to incinerate and destroy them all (IUCN/UNEP, 1988: 168), a process which is still continuing through the Johnston Atoll Chemical Agent Disposal System (known, in American parlance, as JACADS). Although the land tenure is still held by the U.S. Federal Government as an unincorporated territory of the United States administered by the U.S. Defense Nuclear Agency (DNA), Johnston Atoll has been declared a National Wildlife Refuge managed cooperatively by the DNA and the U.S. Fish and Wildlife Service of the Department of the Interior as part of the National Wildlife Refuge system. Johnston Island with its airstrip measures approximately 3.2 km (2 miles) lying northeast to southwest and 1 km (0.06 mile) across. Another tiny island, Sand Island, lies closeby to the northeast, and further off are the islets of Akau (or North Island) and Hikina (or East Island), both man-made, created for military purposes from coral dredgings. The total land area is 2.8 sq. km, and is bounded by a long west to northwest trending reef. The highest point is about 5 metres above sea level. Guano deposits were mined there until about 1890 when depleted. The present population is about 1200 U.S. military and civilian contractor personnel. References to further information on the natural history and geology of Johnston Atoll are on pages 146 to 151 of Volume 3 of *Coral Reefs of the World* (IUCN/UNEP, 1988).

The Marshall Islands, lying about halfway between the Hawaiian Islands and Papua-New Guinea, consist of 29 coral atolls and 5 coral islands of very low elevation (1.5-6 m/5-20 ft) above sea level, a few reaching as high as 7.6 m (25 feet) but most so low, in fact that there is currently concern that with rising sea levels sacred sites and World War II burial grounds on Majuro Atoll are already being eroded by wind and surf (Dominion, 1998). There are also innumerable small reefs and islets (perhaps a thousand or so) scattered through them, all totalling a land area of 180 square km (70 sq. miles) in a sea area of over 770,000 square km of ocean stretching between 4° N and 19° N latitude and 160° to 173° E longitude. This widely dispersed group forms two chains of atolls lying, about 200 km (125 miles) apart, nearly parallel to one another in a northwesterly and southeasterly direction, the more easterly being the Ratak (or Sunrise) Chain and the other the Ralik (or Sunset) Chain. The 5 coral islands lie outside these main chains. However, in the scientific literature the Marshall Islands seem to be more usually referred to as consisting of the Northern and the Southern Marshall Islands. A concise account of the islands has been given by Bryan (1972) and other useful references are listed in the IUCN/UNEP coral reef volume (1986). The *Pacific Islands Yearbook* (various editions) contains much interesting historical, social and geographical information also. Scientific papers on the Marshalls can be found throughout various issues of the *Atoll Research Bulletin* (issued by the Smithsonian Institution), in *Pacific Science*, *Micronesica*, *Coral Reefs*, and for Bikini, especially, in the *U.S. Geological Survey Professional Papers* 260A- (1954) series. A curious blend of military and scientific interests is in the volume by Fosberg (a former distinguished plant biogeographer) and others (Fosberg *et al.* 1956).

Historically, the Marshall Islands have had a varied political evolution, which, interestingly, is reflected in the various scientific expeditions, research and collections that have been carried out there. Sighted in 1529 by the Spanish navigator Alvaro Saavedra, the Marshall Islands were named after a British captain who visited them in 1788. Much exploration of the group was done by Russian expeditions under von Krusenstern in 1803 and von Kotzebue in 1815 and 1823. The islands were formally annexed by Spain in 1686. Subsequently annexed in 1885 by Germany (which also claimed much of the adjoining regions as part of Bismarck's colonial policy for the Pacific resulting in a dispute with Spain which had to be settled with the Pope as arbitrator), they were soon restored to Spain but with some trading rights given to Germany. In 1899 the islands were ceded by Spain to Germany for a payment of \$4 million. Germany tried to establish colonies in the Marshalls but without very much success, and the management of the islands was carried on by private German and Australian companies (which had bitter and prolonged disputes between each other) until 1914 when Japan seized the Marshall Islands. Under the Treaty of Versailles in 1919, Japan was appointed mandatory to the former German possessions north of the Equator, and the Marshalls were handed over to Japan as a "Class C" mandate by the League of Nations. In 1932, in defiance of the League of Nations, Japan annexed the Marshalls outright. During World War II the Marshalls were invaded by American forces at the end of January 1944. In 1946 the United States agreed to administer the former Japanese-mandated islands of Micronesia (except Guam which had already been ceded by Spain to the U.S. in 1898 by the Treaty of Paris after the Spanish-American War) as a Trusteeship for the United Nations, which came into effect in July 1947. The Trust Territory was administered by the U.S. Navy until 1951 when most of the islands were transferred to the U.S. Secretary of the Interior. In July 1975 the Northern Mariana Islands adopted a covenant to establish a Commonwealth of North Mariana Islands in Union with the U.S.A., and they separated in 1976 from the rest of the Trust Territory, including the Marshall Islands which then negotiated a compact of free association with the U.S. "Free association" gives the U.S.A. the authority to control military and defence activities in return for federal government assistance and budget support to the autonomous constitutional government of a country (which involved, in the case of the Marshall Islands, a "once-for-all trust fund of US \$150 million to distribute through a nuclear claims tribunal in the islands, while at the same time blocking any future claims" (Denoon *et al.* 1997: 331). The Marshall Islands became independent of the U.S.-administered U.N. Trusteeship in October 1986, and they are now fully self-governing and known as the Republic of the Marshall Islands, a freely associated state in close association with the U.S.A. The Marshalls are now also becoming fast favourites for recreational diving and other tourist activity. The population of the Marshall Islands is estimated at about 56,000 with 17,600 on the atoll of Majuro, the administrative capital.

The Northern Marshalls include the atolls of Bikini and Enewetak (also called Eniwetok, or, more correctly, Ane-wetak) which were former nuclear testing sites used by the United States from the 1940s to the 1960s. The atoll of Kwajalein, like the others, the scene of intensive military action in World War II, has had a long use as a U.S. missile testing range. A recent history of these military activities has been given by Denoon *et al.* (1997), notably in Chapter 10, "The Nuclear Pacific", pp 326-332 dealing with the Marshall Islands. An earlier, more contemporary, account was given by Hines (1962). Dibblin (1988) has a concise summary also.

Because of this use, these atolls in the Northern Marshalls have been extensively investigated scientifically both before and after tests. A very large amount of geological and biological information has now accumulated. Additionally, during the Japanese tenure of the Marshalls a considerable amount of marine biological research, especially in fisheries, was done there. (cf. Nishi, M. 1968: An evaluation of Japanese agricultural and fishery development in Micronesia during the Japanese mandate, 1914 to 1941. *Micronesica* 4 (1): 1-18). As Sachet (1974: 132) has said - "By accident of geography, atolls have been the most numerous sites of atomic and nuclear atmospheric bomb-tests and, inevitably, the sites of pollution by radionuclides. Between 1946 and 1958, more than 59 tests took place at Eniwetok and Bikini atolls [= 66 according to Denoon *et al.* 1997: 326, map 19]. Later Christmas Island Johnston Islands were involved, and more recently

Mururoa and Fangtaufu Atolls in the Tuamotus. In the Marshall Islands, a survey of the ecosystems had been carried out prior to any tests and periodic resurveys followed. They gave rise to an enormous literature much of it classified or hard-to-get AEC reports. Only after many years did papers appear in scientific journals of more general distribution ... There is much less easily available information on Johnston Island, Christmas Island or the Tuamotus."

Regarding molluscs, Chapter 14 of *The Natural History of Enewetak*, published by the U.S. Department of Energy (Devaney *et al.*, 1987) gives an authoritative checklist of the mollusc species collected over a 40-year period of research, a total of 1116 species (with a gastropod : bivalve ratio of 90 : 10, the highest of all the Pacific faunas for which there are records). By comparison, the mollusc fauna of Hawaii totals 1007 species, with a gastropod : bivalve ratio of 86 : 14 (Kay, 1979). This is an impressive list but the numbers of species are still only 3/5th of those recorded from Okinawa, 2500 km to the northwest (Kay & Johnson, 1987: table 3). There is clearly more work to be done.

Majuro, one of the Ratak chain of the Southern Marshall Islands, is roughly rectangular in shape and consists of some 57 islets with a dry land area of 10 square km (4 sq. miles) and is 33.8 by 4.8 to 16.1 km (21 x 3 to 10 miles) in size surrounding a total lagoon area of 295 square km (113.9 sq. miles). The average temperature is 27° C (81° F) and the rainfall is 3556 mm (140 in.) per year. The chief town is Darrit-Uliga-Dalap (formerly called Majuro) where there are port facilities and an international airport nearby. The Outrigger Hotel & Resort chain has recently completed a luxury 150 room hotel on Majuro where for US\$ 125 per day you can have a room with a lagoon view or for \$235 a "bedroom suite with parlor", and for those who really don't want to get away from it all, there is a "Business Center", a "Fitness Center", meeting and banqueting facilities, and cable TV. I'm sure we of the Shell Club wouldn't miss these! Unlike the Northern Marshalls, Majuro has not been the subject of bomb and missile testing; hence, very much less is known about its geology and natural history. Amesbury *et al.* (1975) did a marine biological survey in connection with a proposed sewer outfall at the eastern end of the atoll, and the reef off Laura, a sheltered area at the western end of the atoll, was surveyed by Dahl *et al.* (1974: especially p. 72, fig. 36). The vegetation of Majuro was described by St John (1951) and the birds (of which there are only 15 species, 7 of which are sea birds, and none of which are known to breed locally, perhaps due to human interference) listed by Amerson (1969). It had been reported (IUCN/UNEP, 1988) that dredging and filling for roads on Majuro had caused pollution. Don Watson's recent observations give evidence of another form of pollution, one familiar from our own beaches.

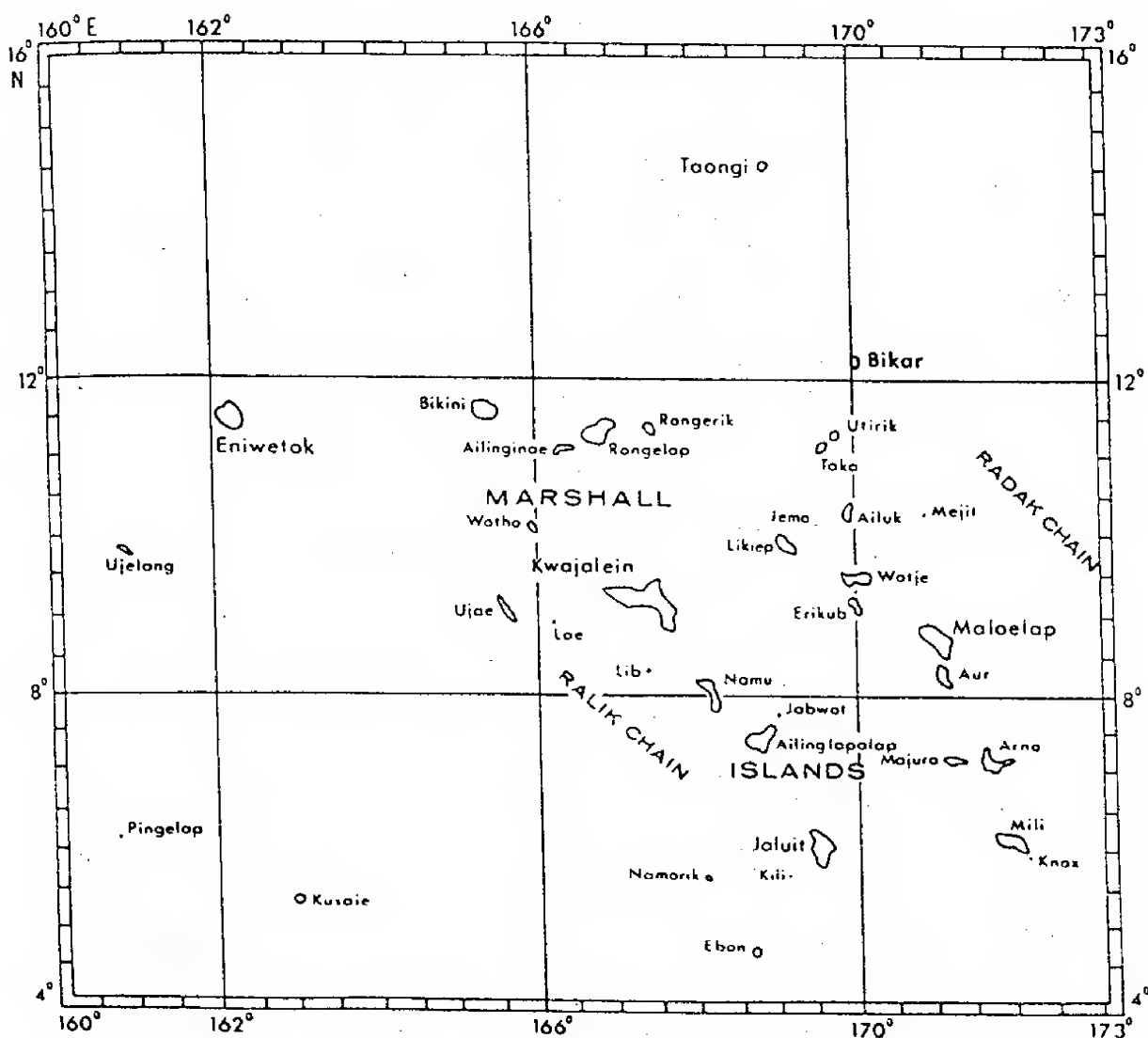
So far as the molluscs are concerned, again, unlike the rich documentation published on the shells of the Northern Marshalls, relatively little information seems available for Majuro and other southern atolls. Certainly Majuro records are included in the various monographs that did appear in the now-defunct *Indo-Pacific Mollusca*, vols 1-3 [1959-1976]. Unfortunately, now, this convenient reference source for collections made in the western Pacific, has now ended publication. However, examination of such maps and listed localities that have appeared, for example, in Cernohorsky's (1976) study of the Mitridae, reveals that of the 12 species of *Mitra* collected by Don Watson on Majuro, only 8 have, apparently, been collected previously on this atoll. Many notes on collecting in the Northern Marshalls, particularly at Kwajalein (for which there is a collecting guide available; Brost & Coale, 1971), have appeared in *Hawaiian Shell News* (also now, most regrettably ceased publication), but I have only readily found two articles there dealing with Majuro shell collecting: Thorsson & McKinsey (1979) and Purtyman (1981).

Thorsson and McKinsey spent a week collecting on Majuro in May 1978 (following an earlier visit about 1974), during which time they collected 169 species - 20 bivalves, 31 cones, 27 cowries, 7 cymatiids/bursids, 10 augers, 6 strombs, 10 cerithiids, and 16 mitrid/vexillids. These were collected from the lagoon at the rear of the hotel, and by diving off various islets on the lagoon side. Some of the species were listed in their account, namely - *Lambis lambis* (Linnaeus, 1758), *L. scorpius* Linnaeus, 1758 (Strombidae), *Cypraea cribraria* Linnaeus, 1758, *C. depressa* Gray, 1824, *C. eglantina* Duclos, 1833, *C. maculifera* (Schilder, 1932), *C. nucleus* Linnaeus, 1758, *C. poraria*

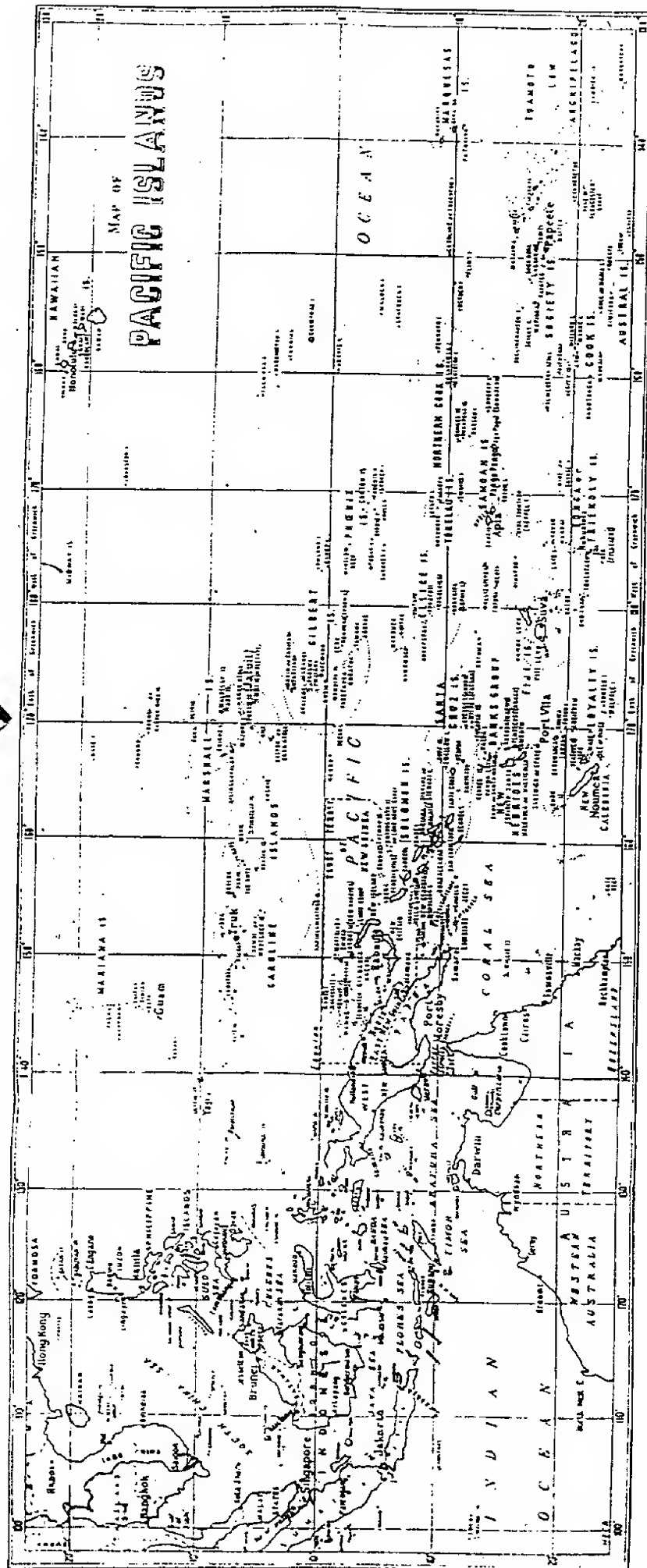
Linnaeus, 1758, *C. punctata* Linnaeus, 1771, *C. stolida* Linnaeus, 1758 (Cypracidae), *Cassia cornuta* Linnaeus, 1758 (Cassididae), *Murex zambor* (Burch & Burch, 1960) (Muricidae), *Conus ammiralis* Linnaeus, 1758, *C. leopardus* Linnaeus, 1758, *C. magus* Linnaeus, 1758 (? *consors* Sowerby, 1833), *C. marmoreus* Linnaeus, 1758, *C. pulicarius* Bruguière, 1792, *C. tulipa* Linnaeus, 1758 (Conidae), *Streptopinna saccata* (Linnaeus, 1758) (Pinnidae), *Lima fragilis* Chemnitz, 1784 (Limidae). Of these 20 species, only 5 are in common with Don Watson's list.

Bob Purtyman collected shells from a shallow lagoon formed as a borrow pit by coral blasting on the ocean side of Rairik Island (on the southeast angle of the atoll) in the 1970s for hard coral for the new breakwater for the Majuro airport and water treatment plant. His species included *Cypraca depressa* Gmelin, 1824, *C. helvola* Linnaeus, 1758, *C. poraria* Linnaeus, 1758, *Bursa bufonia* (Gmelin, 1791), *B. cruentata* (Sowerby, 1841), *B. granularis* (Röding, 1798), *Conus tulipa* Linnaeus, 1758, *C. retifer* Menke, 1829, *Mitra* (*Strigatella*) *acuminata* (Swainson, 1824) and what he called the "super-rare" *Mitra* (*Dibapha*) *multiplicata* (Pease, 1865) which he also figured. Of these 10 species, 5 are in common with Don Watson's list.

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MARSHALL ISLANDS



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LIST OF MARINE MOLLUSCA FROM WELLINGTON HARBOUR AND APPROACHES

By Bruce A. Marshall

Museum of New Zealand Te Papa Tongarewa, P. O. Box 467, Wellington

The following list of 375 species was compiled from lists and articles by Beu & Climo (1971), Burnet (1992, 1995), Climo (1973), Iredale & Mestayer (1908), Jamieson & Grange (1984), Marshall (1973), Nunn (1991a, b, c), Raven (1995), Wotton (1974, 1982) and Wellington Shell Club members (1960, 1974), supplemented by material in the collections of the Museum of New Zealand Te Papa Tongarewa (NMNZ) and in the private collections of several local members of the Wellington Shell Club. It is a slightly modified version of my previous list (Marshall 1998), to which the following four species (accidentally omitted from original list) are added: *Theora* (*Endopleura*) *lubrica*, *Haustrum haustorium* and *Austromitra angulata*. Most records are substantiated by registered voucher specimens at NMNZ. Some published records of rare species are based on material in the private collections of members of the Wellington Shell Club, identifications of which have been checked personally. Identifications of most of the shell-less opisthobranchs are based on literature records and previously identified material (NMNZ) that remains to be checked by specialists.

Excluded from the list are some deep-sea Cephalopoda, remains of which occasionally wash ashore in the area: *Spirula spirula* (Linnaeus, 1758) and *Architeuthis dux* Steenstrup, 1857. Also excluded are several extremely doubtful published records that are presumably based on misidentified, dropped or mislocalised specimens.

Coverage includes all marine habitats from the high tidal splash zone to 25 metres depth (the maximum depth of the harbour). Numbers in the column at right indicate records from the inner harbour (1), the harbour narrows (2) and approaches (3), as delineated on the accompanying map. Records of species known to have been taken alive since 1960, based on published lists and NMNZ collections, are indicated by asterisks. It should be noted, however, that there is no evidence that species recorded from shells alone are not living in the area.

Most of the Mollusca occurring in the Wellington area are widely distributed in the New Zealand region. A few species have their northern and southernmost distributional limits there. Particularly noteworthy species of marine Mollusca living in the Wellington area include *Proneomenia quincarinata* Ponder, 1970, still known by only two specimens, one from off Island Bay, the other from the Chatham Islands; *Montfortula chathamensis* Finlay, 1928, which is occasionally found on intertidal rocks at the approaches and otherwise known only from Kaikoura and the Chatham Islands; and *Smeagol climoi* Tillier & Ponder, 1992, which is only known from high-tidal gravel near Houghton Bay. The only known introduced species are *Crassostrea gigas* (Thunberg, 1793), first recorded from Island Bay in 1991 (Nunn, 1991), and *Theora* (*Endopleura*) *lubrica* Gould, 1861, first recorded from the inner harbour in 1988 (Wear & Haddon, 1988). With the exception of surveys of the fauna from soft substrata in the harbour [zones 1 & 2] by the New Zealand Oceanographic Institute in 1964 during which 123 stations, mostly between 9 and 25 metres, were sampled by orange-peel grab, yielding 35 species of bivalves, 19 species of gastropods, 1 species of scaphopod, and some unidentified nudibranchs and chitons (Dawson, 1988) [material at National Institute of Water and Atmospheric Research, Wellington] and the Zoology Department of Victoria University of Wellington in 1969-70 [material at NMNZ], there has been no comprehensive survey of the total marine molluscan fauna of the Wellington region.

CAUDEOFOVEATA

Proneomenia quincarinata Ponder, 1970 3*

AMPHINEURA

Leptochiton inquinatus (Reeve, 1847) 3*
Ischnochiton maorianus Iredale, 1914 1, 2*, 3*
Callochiton crocinus (Reeve, 1847) 2, 3
Callochiton kapitensis Mestayer, 1926 3
Eudoxochiton nobilis (Gray, 1843) 2, 3*
Lorica haurakiensis Mestayer, 1921 2*
Plaxiphora biramosa (Quoy & Gaimard, 1835) 3
Plaxiphora caelata (Reeve, 1847) 3
Plaxiphora (Frembleya) egregia H. Adams, 1866 3*
Chiton (Amaurochiton) glaucus Gray, 1828 1*, 2*, 3*
Rhyssoplax aerea (Reeve, 1847) 3
Sypharochiton pelliserpentis (Quoy & Gaimard, 1835) 1, 2, 3*
Sypharochiton sinclairi (Gray, 1843) 3*
Onithochiton neglectus Rochebrune, 1881 1, 2, 3*
Acanthochitona zelandica (Quoy & Gaimard, 1835) 2*, 3*
Cryptoconchus porosus Burrow, 1815 1*, 2*, 3*
Notoplax mariae (Webster, 1908) 2*
Phacellopleura violacea (Quoy & Gaimard, 1835) 2*, 3*
Pseudotonicia cuneata (Suter, 1908) 1*

BIVALVIA

Solemya (Solemyrina) parkinsonii Smith, 1874 1*, 2, 3
Nucula hartvigiana Pfeiffer, 1864 1*, 2, 3*
Nucula nitidula A. Adams, 1856 3*
Austronucula schencki Powell, 1939 3
Nucula species 3*
Leionucula strangei (A. Adams, 1856) 1*
Saccella bellula (A. Adams, 1856) 1
Neilo australis (Quoy & Gaimard, 1835) 1*
Barbatia novaezelandiae Smith, 1915 2, 3
Acar sandersonae Powell, 1933 3
Glycymeris (Glycymerula) modesta (Angas, 1879) 2, 3
Tucetona laticostata (Quoy & Gaimard, 1835) 1, 2, 3

<i>Cosa costata</i> (Bernard, 1896)	3
<i>Cosa filholi</i> (Bernard, 1897)	2, 3
<i>Lissarca trapezina</i> (Bernard, 1897)	3
<i>Philobrya meleagrina</i> (Bernard, 1896)	3
<i>Philobrya munita</i> (Finlay, 1930)	3
<i>Verticoprionus mytilus</i> Hedley, 1904	3
<i>Aulacomya atra maoriana</i> (Iredale, 1915)	1*, 2*, 3*
<i>Mytilus edulis galloprovincialis</i> Lamarck, 1819	1*, 2*, 3*
<i>Perna canaliculus</i> (Gmelin, 1791)	1*, 2*, 3*
<i>Modiolarca impacta</i> (Hermann, 1782)	1, 2*, 3
<i>Trichomusculus barbatus</i> (Reeve, 1858)	3
<i>Zelithophaga truncata</i> (Gray, 1843)	3
<i>Modiolus areolatus</i> (Gould, 1850)	1*, 2*, 3*
<i>Xenostrobus pulex</i> (Lamarck, 1819)	1*, 2*, 3*
<i>Atrina zelandica</i> (Gray, 1835)	1, 2*, 3
<i>Crassostrea gigas</i> (Thunberg, 1793)	3*
<i>Ostrea lutaria</i> Hutton, 1873	1, 2, 3
<i>Mesopeplum convexum</i> (Quoy & Gaimard, 1835)	1
<i>Pecten novaezelandiae</i> Reeve, 1853	1, 2, 3
<i>Talochlamys zelandiae</i> (Gray, 1843)	1*, 2*, 3*
<i>Talochlamys gemmulata</i> (Reeve, 1853)	1*, 2*, 3
<i>Cycloclamys transenna</i> (Suter, 1913)	3
<i>Pododesmus zelandicus</i> (Gray, 1843)	2*, 3
<i>Limatula maoria</i> Finlay, 1926	2, 3
<i>Divaricella (Divalucina) cumingii</i> (Adams & Angas, 1864)	3
<i>Diplodonta (Zemysina) globus</i> Finlay, 1926	1*, 2, 3
<i>Diplodonta (Zemysina) striatula</i> Finlay, 1926	1, 2
<i>Lasaea hinemoa</i> Finlay, 1928	1, 2, 3*
<i>Lasaea maoria</i> Powell, 1933	3
<i>Arthritica bifurca</i> (Webster, 1908)	1*, 2, 3
<i>Arthritica crassiformis</i> Powell, 1933	1
<i>Borniola decapitata</i> (Powell, 1939)	3
<i>Borniola reniformis</i> (Suter, 1908)	1, 2, 3*
<i>Melliteryx parva</i> (Deshayes, 1856)	1*, 3*
<i>Myllita (Zemyllita) stoweri</i> (Hutton, 1873)	3

<i>Kellia cycladiformis</i> (Deshayes, 1834)	3
<i>Mysella hounselli</i> (Powell, 1931)	1*
<i>Mysella unidentata</i> (Odhner, 1924)	3
<i>Divariscintilla maoria</i> Powell, 1932	3
<i>Scintillona zelandica</i> (Odhner, 1924)	1*, 3
<i>Kidderia</i> (<i>Costokidderia</i>) <i>costata</i> Odhner, 1924	3
<i>Neolepton antipodum</i> (Filhol, 1880)	1, 2, 3*
<i>Pachykellya minima</i> Powell, 1931	3
<i>Puyseguria cuneata</i> Powell, 1927	3
<i>Puyseguria prognata</i> Powell, 1927	3
<i>Anisodonta</i> (<i>Tahunanuia</i>) <i>alata</i> (Powell, 1952)	1, 3
<i>Cardita aoteana</i> Finlay, 1926	2, 3*
<i>Pleuromeris marshalli</i> (Marwick, 1924)	2
<i>Venericardia</i> (<i>Purpurocardia</i>) <i>purpurata</i> (Deshayes, 1854)	2
<i>Pratulum pulchellum</i> (Gray, 1843)	1*, 2
<i>Cyclomactra ovata</i> (Gray, 1843)	1*
<i>Cyclomactra tristis</i> (Reeve, 1854)	1
<i>Mactra discors</i> Gray, 1837	1, 3
<i>Maorimactra ordinaria</i> (Smith, 1898)	3
<i>Oxyperas</i> (<i>Pseudoxyperas</i>) <i>elongata</i> (Quoy & Gaimard, 1835)	1, 2
<i>Scalpomactra scalpellum</i> (Reeve, 1854)	1, 2
<i>Spisula</i> (<i>Crassula</i>) <i>aequilatera</i> (Deshayes in Reeve, 1854)	3*
<i>Resania lanceolata</i> Gray, 1853	3
<i>Zenatia acinaces</i> (Quoy & Gaimard, 1835)	1*, 3
<i>Paphies australis</i> (Gmelin, 1791)	1*, 2, 3
<i>Paphies subtriangulata</i> (Wood, 1828)	3*
<i>Elliptotellina urinatoria</i> (Suter, 1913)	2
<i>Macomona liliana</i> (Iredale, 1915)	1*, 2, 3
<i>Moerella huttoni</i> (Smith, 1885)	1, 2*
<i>Peronaea gaimardi</i> (Iredale, 1915)	3
<i>Pseudarcopagia disculus</i> (Deshayes, 1855)	1, 2, 3*
<i>Tellinota edgari</i> (Iredale, 1915)	1*
<i>Gari</i> (<i>Gobraeus</i>) <i>stangeri</i> (Gray, 1843)	1, 2, 3
<i>Gari</i> (<i>Psammobia</i>) <i>conversa</i> (Reeve, 1857)	1, 3*
<i>Gari</i> (<i>Psammobia</i>) <i>lineolata</i> (Gray, 1835)	1*, 2, 3

<i>Soletellina nitida</i> (Gray, 1843)	2, 3
<i>Soletellina siliquens</i> Willan, 1993	1*
<i>Leptomya retiaris</i> (Hutton, 1885)	1*, 2, 3
<i>Theora</i> (<i>Endopleura</i>) <i>lubrica</i> Gould, 1861	1*
<i>Dosina zelandica</i> Gray, 1835	1*, 2, 3
<i>Austrovenus stutchburyi</i> (Wood, 1828)	1*, 2, 3*
<i>Bassina</i> (<i>Callanaitis</i>) <i>yatei</i> (Gray, 1835)	1*, 2, 3
<i>Protothaca</i> (<i>Tuangia</i>) <i>crassicosta</i> (Deshayes, 1835)	1, 2*, 3*
<i>Tawera spissa</i> (Deshayes, 1835)	1, 2, 3*
<i>Dosinia</i> (<i>Asa</i>) <i>lambata</i> (Gould, 1850)	1*, 3
<i>Dosinia</i> (<i>Austrodosinia</i>) <i>anus</i> (Philippi, 1848)	3*
<i>Dosinia</i> (<i>Kereia</i>) <i>greyi</i> Zittel, 1864	1*, 3
<i>Dosinia</i> (<i>Phacosoma</i>) <i>maoriana</i> Oliver, 1923	2, 3
<i>Dosinia</i> (<i>Phacosoma</i>) <i>subrosea</i> (Gray, 1835)	3*
<i>Notocallista</i> (<i>Striacallista</i>) <i>multistriata</i> (Sowerby, 1851)	1
<i>Irus</i> (<i>Notirus</i>) <i>reflexus</i> (Gray, 1843)	3*
<i>Irus</i> (<i>Notopaphia</i>) <i>elegans</i> (Deshayes, 1854)	1, 3
<i>Ruditapes largillierti</i> (Philippi, 1849)	1*, 2, 3*
<i>Corbula</i> (<i>Caryocorbula</i>) <i>zelandica</i> Quoy & Gaimard, 1835	1*, 2, 3
<i>Hiatella arctica</i> (Linnaeus, 1767)	1, 2, 3*
<i>Panopea smithae</i> Powell, 1950	1, 3
<i>Panopea zelandica</i> (Quoy & Gaimard, 1835)	1, 2, 3
<i>Barnea</i> (<i>Anchomasa</i>) <i>similis</i> (Gray, 1835)	1
<i>Pholadidea suteri</i> Lamy, 1926	1
<i>Lyrodus pedicellatus</i> (Quatrefages, 1849)	1*
<i>Bankia australis</i> (Calman, 1920)	1*
<i>Bankia neztalia</i> Turner & McKoy, 1979	1*, 3
<i>Nototeredo edax</i> (Hedley, 1895)	1*
<i>Thracia vegrandis</i> Marshall & Murdoch, 1919	2*
<i>Thracia vitrea</i> (Hutton, 1873)	1*, 2
<i>Myadora striata</i> (Quoy & Gaimard, 1835)	2, 3
<i>Cleidothaerus albidus</i> (Lamarck, 1819)	2, 3
<i>Cuspidaria trailli</i> (Hutton, 1873)	1

SCAPHOPODA

Cadulus teliger Finlay, 1926 1

GASTROPODA

Cellana denticulata (Martyn, 1784) 2*, 3*
Cellana ornata (Dillwyn, 1817). 1, 2, 3*
Cellana radians (Gmelin, 1791) 1, 2, 3*
Cellana stellifera (Gmelin, 1791) 2, 3*
Asteracmea suteri (Iredale, 1915) 3
Atalacmea fragilis (Sowerby, 1823) 2*, 3*
Patelloida corticata (Hutton, 1880) 1, 2, 3*
Notoacmea elongata (Quoy & Gaimard, 1834) 3*
Notoacmea helmsi (Smith, 1894) 1
Notoacmea parviconoidea (Suter, 1907) 3*
Notoacmea pileopsis (Quoy & Gaimard, 1834) 1, 2, 3*
Notoacmea scopulina Oliver, 1926 3
Radiacmea inconspicua (Gray, 1843) 1, 2, 3*
Incisura lytteltonensis (Smith, 1894) 1, 2, 3*
Incisura rosea (Hedley, 1904) 2, 3*
Scissurella prendrevillei Powell, 1933 3
Sinezona brevis (Hedley, 1904) 3*
Sinezona laqueus (Finlay, 1926) 3
Sinezona levigata (Iredale, 1908) 3
Sukashitrochus lyallensis (Finlay, 1926) 3
Haliotis (Paua) iris Gmelin, 1791 1, 2*, 3*
Haliotis (Sulculus) australis Gmelin, 1791 1, 2*, 3*
Haliotis (Sulculus) virginea Gmelin, 1791 1, 2, 3
Emarginula striatula Quoy & Gaimard, 1834 1, 2, 3
Montfortula chathamensis Finlay, 1928 3*
Scutus breviculus (Blainville, 1817) 1, 2, 3*
Tugali suteri Thiele, 1916 2*, 3
Cantharidella tessellata (A. Adams, 1851) 1, 2, 3*
Cantharidus opalus (Martyn, 1784) 1, 2, 3*
Cantharidus (Mawhero) purpureus (Gmelin, 1791) 1, 2, 3*
Diloma arida (Finlay, 1926) 2, 3*
Diloma nigerrima (Gmelin, 1791) 2, 3*

<i>Diloma (Cavodiloma) coracina</i> (Philippi, 1851)	3*
<i>Diloma (Fractarmilla) bicanaliculata</i> (Dunker in Philippi, 1845)	1, 2, 3*
<i>Diloma (Fractarmilla) subrostrata</i> (Gray, 1835)	1*, 2
<i>Diloma (Fractarmilla) zelandica</i> (Quoy & Gaimard, 1834)	2, 3*
<i>Melagraphia aethiops</i> (Gmelin, 1791)	1, 2, 3*
<i>Micrelenchus huttonii</i> (Smith, 1876)	1*
<i>Micrelenchus sanguineus</i> (Gray, 1843)	1, 2, 3*
<i>Micrelenchus tenebrosus</i> (A. Adams, 1853)	3*
<i>Micrelenchus (Plumbelenchus) artizona</i> (A. Adams, 1853)	1, 3
<i>Micrelenchus (Plumbelenchus) dilatatus</i> (Sowerby, 1870)	1, 2, 3*
<i>Thoristella chathamensis</i> (Hutton, 1873)	2, 3*
<i>Trochus (Coelotrochus) tiaratus</i> Quoy & Gaimard, 1834	2, 3*
<i>Trochus (Thorista) viridis</i> Gmelin, 1791	3*
<i>Calliostoma (Maurea) punctulatum</i> (Martyn, 1784)	1, 2, 3*
<i>Calliostoma (Maurea) selectum</i> (Dillwyn, 1817)	3
<i>Calliostoma (Maurea) tigris</i> (Gmelin, 1791)	3
<i>Calliostoma (Maurea) waikanae</i> Oliver, 1926	1, 2, 3
<i>Brookula (Aequispirella) corulum</i> (Hutton, 1885)	3
<i>Herpetopoma alacerrima</i> Dell, 1956	3
<i>Herpetopoma bella</i> (Hutton, 1873)	1, 2, 3*
<i>Liotella polypleura</i> (Hedley, 1904)	3*
<i>Antisolarium egenum</i> (Gould, 1849)	1, 2, 3
<i>Zethalia zelandica</i> (Hombron & Jacquinot, 1855)	3
<i>Astraea heliotropium</i> (Martyn, 1784)	1, 3
<i>Cookia sulcata</i> (Gmelin, 1791)	1, 2, 3*
<i>Modelia granosa</i> (Martyn, 1784)	2, 3
<i>Turbo (Lunella) smaragdus</i> Gmelin, 1791	1, 2, 3*
<i>Dolicrossea vesca</i> Finlay, 1926	3
<i>Zalipais lissa</i> (Suter, 1908)	3*
<i>Nerita (Melanerita) atramentosa</i> (Reeve, 1855)	3*
<i>Zeacumantus lutulentus</i> (Kiener, 1841)	1*
<i>Zeacumantus subcarinatus</i> (Sowerby, 1855)	1, 3*
<i>Maoricolpus roseus</i> (Quoy & Gaimard, 1834)	1, 2, 3*
<i>Zeacolpus vittatus</i> (Hutton, 1873)	1
<i>Zeacolpus (Stiracolpus) pagoda</i> (Reeve, 1849)	2, 3

<i>Serpulorbis zelandicus</i> (Quoy & Gaimard, 1834)	2,3
<i>Tenagodus maoria</i> (Powell, 1940)	3
<i>Nodilittorina cincta</i> (Quoy & Gaimard, 1833)	1,2*,3*
<i>Nodilittorina antipodum</i> (Philippi, 1847)	1,2*,3*
<i>Risellopsis varia</i> (Hutton, 1873)	1,2,3*
<i>Laevilittorina</i> (<i>Macquariella</i>) <i>aucklandica</i> (Powell, 1933)	2,3
<i>Zerotula bicarinata</i> (Suter, 1908)	2,3
<i>Eatoniella albocolumella</i> Ponder, 1965	1*,3*
<i>Eatoniella delli</i> Ponder, 1965	1*,3*
<i>Eatoniella dilatata</i> (Powell, 1955)	2,3
<i>Eatoniella limbata</i> (Hutton, 1883)	2,3*
<i>Eatoniella lutea</i> (Suter, 1908)	2*,3*
<i>Eatoniella minutocrassa</i> Ponder, 1965	3*
<i>Eatoniella mortoni</i> Ponder, 1965	2*,3*
<i>Eatoniella notalabia</i> Ponder, 1965	3*
<i>Eatoniella olivacea</i> (Hutton, 1882)	1*,2*,3*
<i>Eatoniella pfefferi</i> (Suter, 1909)	3*
<i>Eatoniella roseocincta</i> (Suter, 1908)	3
<i>Eatoniella roseola</i> (Iredale)	2
<i>Eatoniella varicolor</i> Ponder, 1965	2*,3*
<i>Eatoniella</i> (<i>Albosabula</i>) <i>lampra</i> (Suter, 1908)	2*,3*
<i>Eatonina atomaria</i> (Powell, 1933)	1*,2,3*
<i>Tubbreva exaltata</i> (Powell, 1933)	1*
<i>Tubbreva exigua</i> (Ponder, 1965)	1*,3*
<i>Amphithalamus latisulcus</i> (Ponder, 1968)	3*
<i>Amphithalamus semen</i> (Odhner, 1924)	2,3
<i>Anabathron</i> (<i>Scrobs</i>) <i>hedleyi</i> (Suter, 1908)	2,3*
<i>Pisinna impressa</i> (Hutton, 1885)	1,2,3
<i>Pisinna rekohuana</i> (Powell, 1933)	2,3*
<i>Pisinna zosterophila</i> (Webster, 1905)	3*
<i>Merelina lyalliana</i> (Suter, 1898)	2,3*
<i>Onoba loveauxiana</i> (Suter, 1898)	2,3
<i>Onoba fumata</i> (Suter, 1898)	2,3
<i>Onoba insculpta</i> (Murdoch, 1905)	3
<i>Onoba</i> (<i>Ovirissoa</i>) <i>delli</i> (Ponder, 1968)	3

<i>Powellisetia subtenuis</i> (Powell, 1937)	3
<i>Pusillina</i> (<i>Haurakia</i>) <i>hamiltoni</i> (Suter, 1898)	2, 3*
<i>Pusillina</i> (<i>Haurakia</i>) <i>infecta</i> (Suter, 1908)	3*
<i>Rissoina chathamensis</i> (Hutton, 1873)	1, 2, 3*
<i>Suterilla neozelanica</i> (Murdoch, 1899)	3*
<i>Nozeba emarginata</i> (Hutton, 1885)	2, 3
<i>Elachorbis subtateri</i> (Suter, 1907)	2, 3
<i>Caecum</i> (<i>Brochina</i>) <i>digitulum</i> Hedley, 1904	3*
<i>Struthiolaria papulosa</i> (Martyn, 1784)	1*, 2, 3
<i>Struthiolaria</i> (<i>Pellicaria</i>) <i>vermis</i> (Martyn, 1784)	2
<i>Crepidula monoxyla</i> (Lesson, 1831)	1, 2, 3
<i>Calyptraea</i> (<i>Sigapatella</i>) <i>novaezelandiae</i> (Lesson, 1831)	1, 2, 3*
<i>Calyptraea</i> (<i>Zegalerus</i>) <i>tenuis</i> (Gray, 1867)	1*, 2, 3
<i>Trichosirius inornatus</i> (Hutton, 1873)	1, 2, 3
<i>Trivia</i> (<i>Niveria</i>) <i>merces</i> (Iredale, 1924)	3
<i>Lamellaria cerebroides</i> Hutton, 1882	3
<i>Lamellaria ophione</i> Gray, 1850	3
<i>Tanea zelandica</i> (Quoy & Gaimard, 1832)	1, 2, 3*
<i>Semicassis pyrum</i> (Lamarck, 1822)	2, 3
<i>Argobuccinum pustulosum tumidum</i> (Dunker, 1862)	1, 2*, 3*
<i>Cabestana spengleri</i> (Perry, 1811)	3*
<i>Prolixodens infracolor</i> (Laseron, 1951)	3
<i>Tasmalira vitrea</i> (Suter, 1908)	3
<i>Synthopsis acuminata</i> Marshall, 1978	3
<i>Zachys murdochi</i> Marshall, 1978	3
<i>Metaxia exaltata</i> (Powell, 1930)	3
<i>Sagenotriphora ampulla</i> (Hedley, 1902)	2
<i>Teretriphora huttoni</i> (Suter, 1908)	3
<i>Epitonium</i> (<i>Hyaloscala</i>) <i>jukesianum</i> (Forbes, 1852)	3*
<i>Janthina exigua</i> Lamarck, 1822	3
<i>Janthina janthina</i> (Linnaeus, 1758)	3
<i>Graphis blanda</i> (Finlay, 1924)	3
<i>Larochella alta</i> Powell, 1927	3*
<i>Larochella toreuma</i> Powell, 1927	3
<i>Fusceulima murdochi</i> (Hedley, 1904)	3

<i>Curveulima titahica</i> (Suter, 1908)	3
<i>Comptella</i> species	3
<i>Uttleya marwicki</i> Powell, 1952	1, 2
<i>Xymene aucklandicus</i> (Smith, 1902)	3
<i>Xymene ambiguus</i> (Philippi, 1844)	2, 3
<i>Xymene plebeius</i> (Hutton, 1873)	1*
<i>Xymene pusillus</i> (Suter, 1907)	1, 2*
<i>Xymene traversi</i> (Hutton, 1873)	2, 3*
<i>Haustrum haustorium</i> (Gmelin, 1791)	1*, 2*, 3*
<i>Lepsiella albomarginata</i> (Deshayes, 1839)	1, 3*
<i>Lepsiella scobina</i> (Quoy & Gaimard, 1833)	3*
<i>Lepsithais lacunosus</i> (Bruguière, 1789)	2, 3*
<i>Dicithais orbita</i> (Gmelin, 1791)	1, 2, 3*
<i>Austrofuscus glans</i> (Röding, 1798)	1, 2, 3*
<i>Buccinulum linea</i> (Martyn, 1784)	1, 2*, 3*
<i>Buccinulum pallidum</i> Finlay, 1928	2*
<i>Buccinulum vittatum</i> (Quoy & Gaimard, 1833)	1, 2*, 3*
<i>Cominella adspersa</i> (Bruguière, 1789)	1*, 2, 3
<i>Cominella maculosa</i> (Martyn, 1784)	1, 2*, 3*
<i>Cominella</i> (Joseph) <i>glandiformis</i> (Reeve, 1847)	1*
<i>Cominella virgata</i> H. & A. Adams, 1853	1, 2*, 3*
<i>Penion sulcatus</i> (Lamarck, 1816)	1*, 2, 3
<i>Macrozafra nodicincta</i> (Suter, 1899)	3
<i>Macrozafra subabnormis</i> (Suter, 1899)	3
<i>Paxula paxillus</i> (Murdoch, 1905)	3
<i>Zemitrella choava</i> (Reeve, 1859)	3*
<i>Zemitrella</i> species	3*
<i>Alcithoe arabica</i> (Gmelin, 1791)	1*, 3
<i>Alcithoe</i> (<i>Leporemax</i>) <i>fusus</i> (Quoy & Gaimard, 1833)	2, 3
<i>Amalda</i> (<i>Baryspira</i>) <i>australis</i> (Sowerby, 1830)	2, 3
<i>Amalda</i> (<i>Baryspira</i>) <i>depressa</i> (Sowerby, 1859)	3
<i>Amalda</i> (<i>Baryspira</i>) <i>mucronata</i> (Sowerby, 1830)	1, 2, 3
<i>Amalda</i> (<i>Gracilispira</i>) <i>novaezelandiae</i> (Sowerby, 1859)	1, 3
<i>Dentimargo cairoma</i> (Brookes, 1924)	3*
<i>Mesoginella larochei</i> (Powell)	2

<i>Austromitra angulata</i> (Suter, 1908)	3
<i>Austromitra rubiginosa</i> (Hutton, 1873)	2, 3
<i>Phenatoma rosea</i> (Quoy & Gaimard, 1833)	1, 2
<i>Tomopleura</i> (<i>Maoritomella</i>) <i>albula</i> (Hutton, 1873)	1, 2
<i>Liracraea odhneri</i> Powell, 1942	1, 3
<i>Neoguraleus lyallensis</i> (Murdoch, 1905)	1, 2, 3
<i>Neoguraleus murdochi</i> (Finlay, 1924)	3
<i>Neoguraleus sinclairi</i> (Gillies, 1882)	2, 3
<i>Pervicacia tristis</i> (Deshayes, 1859)	2, 3
<i>Brookesena succincta</i> (Suter, 1908)	3
<i>Omalogyra fusca</i> Suter, 1908	3*
<i>Orbitestella parva</i> (Finlay, 1924)	3*
<i>Orbitestella toreuma</i> Powell, 1930	3*
<i>Rissoella elongatospira</i> Ponder, 1966	3*
<i>Rissoella flemingi</i> Ponder, 1968	3*
<i>Rissoella</i> (<i>Jeffreysiella</i>) <i>rissoaformis</i> (Powell, 1939)	3*
<i>Rissoella</i> (<i>Zelaxitas</i>) <i>cystophora</i> (Finlay, 1924)	3*
<i>Rissoella</i> (<i>Zelaxitas</i>) <i>micra</i> (Finlay, 1924)	3*
<i>Evalea sabulosa</i> (Suter, 1907)	2, 3
<i>Gumina dolichostoma</i> (Suter, 1908)	2, 3
<i>Linopyrga rugata</i> (Hutton, 1886)	1, 2, 3
<i>Odostomia murdochi</i> Suter, 1913	2
<i>Odostomia vaga</i> Laws, 1939	1, 2
<i>Odostomia</i> species A	2, 3
<i>Odostomia</i> species B	1
<i>Chemnitzia cookiana</i> Laws, 1937	3
<i>Chemnitzia zealandica</i> Hutton, 1873	2, 3
<i>Chemnitzia</i> species	3
<i>Eulimella</i> species A	3
<i>Eulimella</i> species B	3
<i>Striarcana cryptolira</i> Laws, 1937	3
<i>Retusa oruaensis</i> (Webster, 1908)	2, 3
<i>Cylichna thetidis</i> (Hedley, 1903)	3
<i>Cylichnina opima</i> Finlay, 1926	3
<i>Philine auriformis</i> (Suter, 1909)	1

<i>Philine powelli</i> Rudman, 1970	3
<i>Melanochlamys cylindrica</i> (Cheeseman, 1881)	3
<i>Aplysia juliana</i> (Quoy & Gaimard, 1832)	3
<i>Aplysia</i> (<i>Varria</i>) <i>keraudrini</i> Rang, 1828	3
<i>Aplysia</i> (<i>Pruvotaplysia</i>) <i>parvula</i> Guilding in Mörch, 1863	3
<i>Limacina</i> species	3
<i>Diacria trispinosa</i> (Blainville, 1821)	3
<i>Berthella medietas</i> Burn, 1962	2
<i>Berthella ornata</i> (Cheeseman, 1878)	2, 3
<i>Pleurobranchaea maculata</i> (Quoy & Gaimard, 1832)	3
<i>Okadaia cinnabarea</i> (Ralph, 1944)	3
<i>Archidoris wellingtonensis</i> (Abraham, 1877)	1*, 2, 3
<i>Atagema carinata</i> (Quoy & Gaimard, 1832)	1
<i>Chromodoris aureomarginata</i> Cheeseman, 1881	2
<i>Cadlina willani</i> Miller, 1980	3*
<i>Janolus novozealandicus</i> (Eliot, 1907)	1
<i>Onchidella flavescens</i> Wissel, 1904	1
<i>Onchidella nigricans</i> (Quoy & Gaimard, 1832)	1 & 2
<i>Smeagol climoi</i> Tillier & Ponder, 1992	3*
<i>Gadinia conica</i> Angas, 1867	3
<i>Benhamina obliquata</i> (Sowerby, 1825)	3*
<i>Siphonaria australis</i> Quoy & Gaimard, 1833	1, 2, 3*
<i>Siphonaria propria</i> Jenkins, 1983	3*
<i>Amphibola crenata</i> (Gmelin, 1791)	1*, 3
<i>Leuconopsis obsoleta</i> (Hutton, 1878)	3*
<i>Marinula filholi</i> Hutton, 1878	2, 3*

CEPHALOPODA

<i>Sepioteuthis australis</i> (Quoy & Gaimard, 1832)	1
<i>Sepioloidea pacifica</i> (Kirk, 1882)	1
<i>Nototodarus sloanii</i> (Gray, 1849)	2
<i>Octopus huttoni</i> (Benham, 1943)	2*, 3*
<i>Pinnoctopus cordiformis</i> (Quoy & Gaimard, 1832)	2*, 3*
<i>Argonauta nodosa</i> Lightfoot, 1786	3

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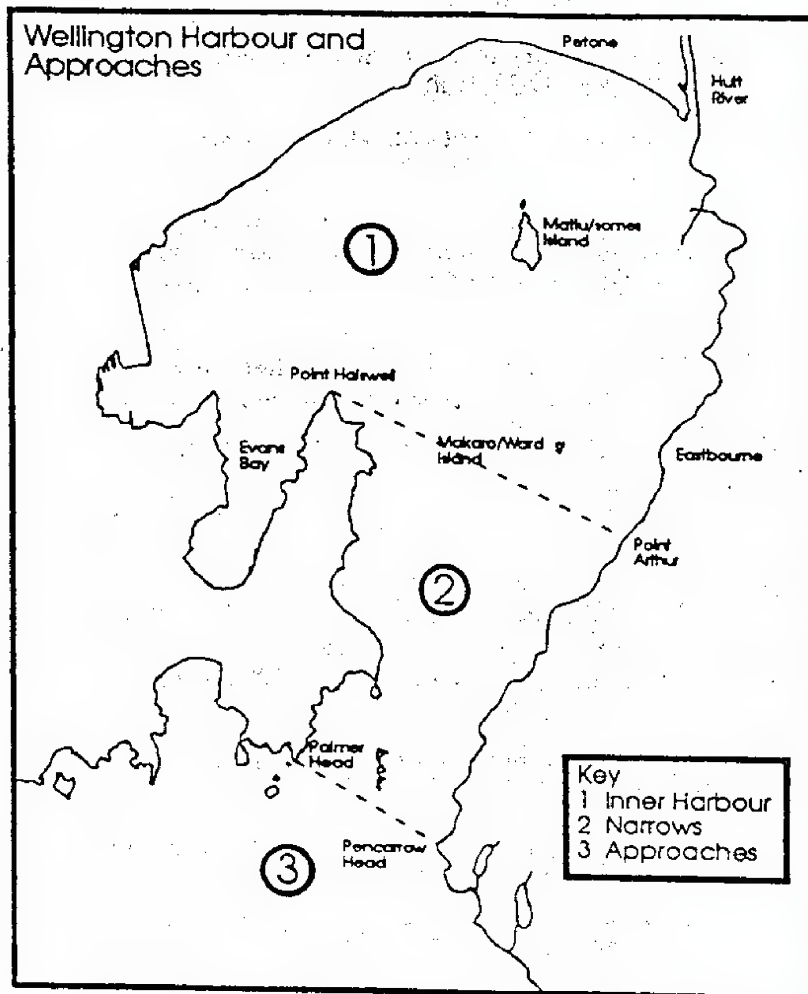
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Wellington Harbour and approaches showing zones used in this list.



SHELL LIFE ABOUT WELLINGTON HARBOUR -

COMMENT ON THE MOLLUSCS FROM THE APPROACHES

By Jenny Raven

The recently published list of marine molluscs found in Wellington Harbour by Bruce Marshall (1998) divides the harbour into three zones. The Wellington Shell Club has made many trips around the harbour over the years and this list is, to a large part, a reflection of these findings (cf. references in Marshall 1998: 155). Several of the Club's recent trips have been to the "Zone Three" area (the "Approaches") and the following is comment on this zone.

Zone Three is a prolific area for shell life. About 80% of the species in the list are found here. On the city side of the harbour, Zone Three covers from the exposed rocky southern coast through sandy beaches and rocky headlands to Palmer Head. Starting at the south coast the main bays are Ohiro, Island, Houghton, Princess, Lyall, and Tarakena. Wash-ups are not common but are best at the southern end of Lyall Bay and Arthur's Nose. Good shell sand can usually be found on the rock platforms facing Island Bay out from the changing rooms at Princess Bay. Over 35% of the species listed under Zone Three are less than 5 mm in height, and many were found here. Commonly living in the intertidal zone throughout Zone Three are *Cellana denticulata*, *Haustrum haustorium*, *Cominella maculosa* and juvenile paua, *Haliotis iris*. The healthy paua population should have been helped over the years by the operation of numerous sewer outfalls throughout this zone deterring food gatherers.

From the southern coast to Ohiro Bay the shell life is less prolific probably because of its very exposed nature. Shell life picks up on the northern side of the Ohiro Bay where wash-ups sometimes occur and a few rare specimens (and the only North Island record) of *Montfortula chathamensis* have been found (Nunn, 1991).

Cominella maculosa is common from Island Bay to Princess Bay. Live *Thoristella chathamensis* are found under low tide rocks in this area and are common in the Princess Bay shell sand. Large, grey *Cantharidus opalus* are not uncommon attached to the leathery brown weed floating just below low tide. Using a stick to move the weed will often help to show them. *Cantharidella* and *Micrelenchus* species are common on the weed. Occasionally large (>8mm), dark, *Cantharidella tessellata* are found under low tide stones and *Benhamina obliquata* on the dark side of large midtide rocks. *Pseudarcopagia disculus* and *Protothaca crassicosta* are the common bivalves in this area.

From Arthur's Nose to Lyall Bay *Cominella virgata* supersedes *Cominella maculosa*. The sporadic wash-ups at Lyall Bay may relate to its changing nature. The airport has intruded well into the bay for a good many years necessitating a breakwater and heavy boulder protection work. The main Wellington city sewer has operated since last century until this year from just beyond the head of Lyall Bay near Moa Point. Most of the time Lyall Bay is a sheltered environment but every so often it takes the full brunt of a southerly blow. At times I have noticed the sand moving in and covering all the rocks including the small colony of *Diloma coracina* that I had noted living in the low tide pools at the southern end. Last year, with the sand building up, a new beach appeared alongside the airport roadway. The construction of the new long outfall pipe off the south end of the bay during the year may have assisted this. Soon after I noted adult pauas, white rock shells (*Dicathais orbita*), and mussels that were normally living a lot deeper were now becoming surrounded by shallow water with many falling off as the sand moved in. This resulted in shell wash-ups at this end of the beach a few weeks later. With the winter storms the sand has retreated and normal depth levels have returned around the rocks.

Other unusual occurrence which I noted at Lyall Bay during the year were the wash-up of numbers of juvenile *Ruditapes largillierii* and adult tuatua (*Paphies subtriangulata*) containing the animal, and a couple of times I noted colonies of juvenile *Tawera spissa* popping out of the sand to lie upon the surface. Sandy shore dwellers have become more prevalent. *Austrofusus chathamensis* has been recorded from Lyall Bay. From a young age I was disappointed that I could not find it there. In the past 18 months live ones washed in have been a common occurrence. *Cantharidus purpureus* is frequently washed in live amongst rocks at the south end, and live *Calliostoma punctulatum* with a wide body whorl occasionally seen. *Zethalia zelandica* wash-ups are, however, not as common as they used to be. Although the white rock shell (*Dicathais orbita*) occurs sporadically throughout Zone Three it appears to have found a favourable habitat in the overhanging spaces formed by the boulders lining the road alongside the airport and are plentiful there.

The point generally known as Moa Point* is accessible through a narrow crossing only at low tide. In spring its surface is covered with masses of bright orange *Ganzania* flowers. The Club held a field trip here last year when the main Wellington sewer was still operating alongside. We noted that shell life was still prolific on the Lyall Bay side but became rather sparse on the sewer side. Only *Cellana denticulata* was dominant near the sewer and large in size. On the Lyall Bay side of the peninsula was the back shield slug *Scutus antipodes* and white and dark rock shells were common; also *Atalacmea fragilis* and *Diloma bicanalicuta* were close together under flat stones. It was of interest to find *Nerita atramentosa* in a small colony at the tip of the point. A few others are known close by at Palmer Head. This species has been there for the past 30 years. *Nerita* is uncommon round Wellington (Raven 1995), and, as a new collector, I remember thinking I had made a rare find when I first noted live ones at Palmer Head.

From the sewer to Tarakena Bay the shell life increases. Small pockets of shell can be found on either side of this sandy bay. Nearby Palmer Head, like Moa Point, forms an isthmus extending out into the sea. Here a further reef is exposed offshore causing rough seas and wash-ups at the tip of Moa Point. On several occasions seahorses have had the misfortune to be cast up, and an aunt of mine who lived nearby made a collection of these. *Diloma nigerrima* is found along with *Haustrum* and *Haliotis*. In most respects the fauna here is similar to that of the southern side of Moa Point. From Palmer Head the sea conditions generally become a lot calmer as the harbour entrance narrows. From here into the harbour we enter "Zone Two" (the "Narrows").

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[* Old maps showing Maori place names on the Miramar peninsula reveal that the land we now call Moa Point was a peninsula known as Hue-te-taha and Moa Point was the now mainly built over area of rock that forms the base of the breakwater at the southern end of the airport.]

WHAT CONSTITUTES PUBLICATION? (APROPOS "SPENCER & WILLAN, 1995")

By Elliot Dawson

There exists some confusion by authors citing the new checklist of New Zealand molluscs compiled by Hamish G. Spencer and Richard C. Willan, printed by Wilson & Horton, and published by the National Institute of Water and Atmospheric Research Ltd [NIWA] as their *New Zealand Oceanographic Institute Memoir* 105 allegedly in 1995.¹

Maxwell (1996) in a review of this work notes² - "Date on title page is 1995, but it was apparently not distributed until 1996." Most users of "Spencer & Willan", not being aware of any apparent problem regarding its dating, would cite it as of 1995. However, following the lead given by Maxwell (and the doubt that it raises), enquiries to NIWA have revealed that it was originally printed late in 1995 but the printing job was rejected because of unacceptably narrow top margins on the pages. The reprinted job was delivered to NIWA early in 1996 and actually unpacked in February of that year. This has been verified by Bruce Marshall (pers. comm., 3/11/1998) who was given one of the first copies on that occasion.

Under the terms of the National Library 1965,³ the publisher of any work printed in New Zealand shall, within a period of 30 days from the date of publication, deliver to the National Library of New Zealand through the Legal Deposit Office three copies of such work.

This raises the questions immediately of (1) what constitutes a "publication"; (2) at what stage is a work "published"; and (3) if a work is printed but not yet distributed or made known as available, can it be called "published"? Although in the case of "Spencer & Willan", the matter has no direct significance in terms of zoological nomenclature since new taxa were proposed in it (albeit many changes in status of various taxa), it still raises the fundamental questions of what constitutes publication and when.

The *International Code of Zoological Nomenclature*⁴ is quite clear about this (especially, of course, relating to the publication and availability of new names for zoological taxa). Article 8 of the Code ("What constitutes publication") states that a work is to be regarded as published within the meaning of the Code if it complies with 3 stated criteria [which appear to act conjointly and conjunctively, i. e. all 3 criteria have to be satisfied]. These are: "(1) it must be issued publicly for the purpose of providing a permanent scientific record; (2) it must be obtainable, when first issued, free of charge or by purchase, and (3) it must have been produced in an edition containing simultaneously obtainable copies by a method that assures numerous identical copies." Regarding the date of publication, the Rules state (Article 21) that: "The date of publication specified in a work is to be adopted as correct in the absence of evidence to the contrary." And further (Article 21b) - "If the date of publication specified in a work is found to be incorrect, the earliest day on which the work is demonstrated to be in existence as a published work is to be adopted." In the absence of evidence to the actual day, the last day of the month, when month and year, but not day, are specified or demonstrated is to be adopted. Recommendation 21F ("Correction of date") allows the author of a publication to correct "in some suitable manner" an incorrect or incomplete date. In the present case, of course, we are unaware whether one or other or both of the authors would agree with the reasoning presented herein.

Turning aside from science for the moment, so far as a legal opinion is concerned as to what might constitute "publication", it is (as any first-year law student would recognise⁵) a simple case of identifying an issue and determining the natural meaning of the problem word or phrase used in that issue. There are two sources used in the legal system which help to determine the natural meaning of words. These are (a) the dictionary - in the Victoria University Law School this is *The Concise Oxford Dictionary of Current English*,⁶ and (b) examples of ordinary usage - examples which show the way in which words are customarily used. There are, however, at least seven different reasons why a dictionary definition cannot be determinative or unchallengeable.⁵

rights are protected, the continuing existence of "withdrawn" (but still potentially quotable) copies of publications, the bugbear of "internal reports", many nevertheless issued and freely available (but unquotable without the author's or publisher's permission), and an example of at least one case of establishing priority of a new name that was able to be resolved by the date stamp of legal deposit - all this and more could be told, but what I have written here will suffice. It is clear that "publication" is not always as simple as it looks.

As an editor, it is my task to ensure accuracy and truth in dealing with authors' contributions. It is clear concerning the matter of "Spencer & Willan, 1995" that this work was not published, from a practical point of view (as well as from a legal aspect) until it was unpacked from the printer and the first copies "issued" to the "public" (whomsoever they or it be!). I do not believe we should perpetuate doubts and known errors. Phil Maxwell's note was a challenge to our integrity!

NOTES

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- 4 *International Code of Zoological Nomenclature*. Third Edition. 1985. London: International Trust for Zoological Nomenclature. Pp xx + 1-388.
- 5 *Laws 101. The Legal System. Statutory Interpretation Materials* (1993). Wellington: Victoria University of Wellington, Faculty of Law. Pp [iii] + 1-178. [Not "published" since only available to enrolled members of Laws 101 class of a particular year by purchase - \$12.90 in 1993.]
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- 15 McLay, C.L. 1985: Crabs of Northern New Zealand / Brachyura and crab-like Anomura of northern New Zealand. *Leigh Laboratory Bulletin* 19: iv + 1-387, illus.; 16 McLay, C.L. 1988: Crabs of New Zealand / Brachyura and crab-like Anomura of New Zealand. *Leigh Laboratory Bulletin* 22: iv + 1-463, figs 1-85.

ALGAL BLOOM IN WELLINGTON HARBOUR

By Deirdre Standish

Recently, our harbour was struck by an algal bloom. The culprits were species of the microscopic single-celled oxygen-producing plants known as Algae (which include also macroscopic members such as the familiar seaweeds of our shores and offshore waters). The creation of more algae than usual isn't in itself always a bad thing as more food can be produced for other creatures in the food chain but this particular species was one of the toxic forms which fairly quickly killed much of the sea life in the harbour.

Digby and I had heard about the bloom, but it wasn't until we went to Eastbourne on Sunday in March of this year that we saw the destruction it caused. The first thing we noticed was the smell, and seeing masses of seaweed everywhere, concluded that that's where it was coming from. Luckily, we thought it wise to keep Kane, the greatest enthusiast for these shell-hunting trips, out of the water, and just as well as he would no doubt have become quite ill. We started fossicking amongst the weed and very quickly, much to my delight, came across a dead seahorse, my favourite sea creature. It wasn't long before my collection was three, and at that stage my excitement waned somewhat - to the extent that I felt quite sick each time I turned over another lump of weed, hoping not to find more. By the end of our search the total number of sea horses had reached twelve, and I felt almost tearful at this.

There were many other marine animals, such as crabs, many kinds of fish and the shield slug *Scutus* lying dead on the beach, and these were but a few. A local resident called out from her house, telling us that the sea gulls had been feeding all morning on all sorts of wash-ups, and warned us to wash our hands very thoroughly when we had finished fossicking because of the likelihood of toxins still in the water. We collected *Ruditapes largillierii*, much larger than usually found there, also stained a rusty or pink colour, reminding me of some we had dredged from Picton Harbour. Another find was *Xymene ambiguus*, many also stained pink and bigger than others previously found there, as well as *Haliotis iris* and *Sigapatella novaezelandiae*. Then came the special finds, which were new to that area, such as *Oxyperus* (*Pseudoxyperas*) *elongata* and *Panopea zelandica*, although the latter wasn't quite perfect. However, two excellent specimens were found there later by Pat Lakeman. About the same time we had found on Petone beach some *Cyclomactra tristis* which were very good examples as well as not normally being found there.

We spent a couple of hours or so amongst the devastation, and, heeding the advice given us, went and bought a cake of antibacterial soap and washed our hands well before going home. That night Digby sneezed and sniffed so much that I was convinced he was getting a male cold - the definition of this, according to my Mum, is that the male suffers far more than any female ever could and lets everyone know by his loud sniffing and snorting! Anyway, my male awoke the next morning fit and healthy, so that we concluded that it had been as a result of the bloom, probably because he is more enthusiastic when it comes to probing amongst debris than I am. It's worth recalling, all the same, that some of these species of toxic algae are known to cause respiratory problems in humans, so our editor tells me (he also remarks that the beach-stranded seaweeds, the macroalgae, were, themselves, most likely victims of the effects of their toxic relations, the microalgae - a nice way to treat members of your own family!).

Speaking to our friends from the Island Bay Marine Centre recently, I was thrilled to hear that sea life is starting to reappear in our harbour, and, hopefully, it could be a very long time before we have such a toxic algal bloom in our waters again.

AN EPILOGUE

On a happier note, Deirdre tells us that she has a very talented sister-in-law, of whom she and Digby are very proud. In her spare time she paints landscapes and also creates pictures from paint and shells. She also writes poetry, for which she has won prizes, and she is now writing a novel based on the Standish family. One of her poems is titled "The Beach" and it forms a fitting conclusion to our thoughts on Wellington Harbour, whether they be the enjoyment of adding to our collective knowledge of the molluscan species that live there - or our sadder experiences with the effects of the toxic algae ...

THE BEACH

By Gayle Tidswell

Yonder,
beneath the edge of vast blue skies
blackish greys in crumbling cloud
there lies,
a heavenly sweep of blue, tinged
strikes as lightning
the treasured prize.
See,
there beneath the crumbling cliff
a hurried tide,
foaming swells, tumbling shells
a seaward ride.
Rushes forward
to beach a sandy taste,
frothing seaweed, pebbles
and other waste.
While sweeping shallows reach
the final tide
bringing gifts, treasures
from the ocean wide.

-oOo-

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1998

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